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B

CHEMICAL AGE

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NCL RESEARCH

DURING three open days last week at the National Chemical Laboratory, (NCL), Teddington, some 1,600 visitors from industry, universities and Government Departments saw work in progress, including several new developments. The research staff is organised into seven main research groups assisted by ancillary services and the present objectives of these groups are: corrosion of metals; microbiology; inorganic chemistry; organic chemistry; high polymers; radiochemistry and chemical engineering.

In endeavouring to reduce losses due to corrosion and prevent breakdowns in industrial cooling systems, tests are being carried out on the corrosion resistance of metals and of the effectiveness of corrosion inhibitors. Results using the volatile corrosion inhibitor cyclohexylamine carbonate (CHC) developed at NCL have proved promising, it is reported, particularly in protection of boilers and other steel equipment in shut-down periods.

Intended for use in chemical analysis and structural diagnosis is a simplified double-beam infra-red spectrometer, which uses a Merton-NPL replica grating on the dispersing element. With this instrument solvent compensation can be achieved and expansion of any part of the absorption scale can be made conveniently.

Of importance economically are various microbial activities. One microbial organism (*Thiobacillus*) has been found which requires no organic food; it lives on sulphur, mineral salts and air, produces strong solutions of sulphuric acid, and likes moist concrete. Not surprisingly, it is responsible for extensive damage to large concrete structures, such as water-cooling towers and sewage conduits. Other microbial organisms under investigation have been found to extract metals from low-grade ores, and to produce sulphur from sewage sludge and gypsum. Such findings are now being studied further for possible industrial application.

Isolation of the rare earth elements by improved ion-exchange techniques has now been worked up to semi-scale. Patents have been applied for and should soon be finalised. Rare earth thulium has been the subject of recent NCL investigations, and appears to have a useful future (see p. 715); semiconductor materials are also to the fore, with particular stress being given to indium, tellurium and bismuth. In investigating purification by zone melting, radioactive tracers are being used.

The inorganic group are also continuing their search for rare elements such as germanium, gallium and selenium in waste products. Selenium was much in the news some 18 months back when there was a serious shortage of this element. It is understood there is still a scarcity of selenium in this country and that, having regard to its source and method of recovery, this scarcity is likely to remain. UK requirements are suggested as being 70 to 80 tons a year, which are imported. Efforts are being made to exploit a potential source arising in the manufacture of sulphuric acid. Small quantities are present in pyrites and the metal finds its way into sludges collecting in wash towers and electrostatic precipitators which form part of the plant. These sludges have been found by NCL and the sulphuric acid manufacturers to contain up to 60 per cent of selenium and could

contribute, it is estimated, some 15 tons per year to UK supplies, an increase of nearly 20 per cent. The NCL has played the leading part in revealing this new source of selenium.

Gallium, in which NCL are showing renewed interest, is found with germanium in flue dusts (2.7 per cent Ge and 0.61 per cent). It has a use in semiconductor alloys, and there is some demand for gallium arsenate. Cost, however, is high, being about £1 per gram (i.e. equivalent to the price of gold). Gallium is of interest, of course, to the Atomic Energy Authority, as a possible coolant for reactors. Problems associated with its use as a thermal transfer metal are its high reactivity and low melting point. The price of gallium in Germany between 1950-1954 varied between 9 and 18 DM per gram and today is reported as 6 to 7 DM per gram (about 11 to 12 shillings per gram) for material of 99.9 per cent purity.

In the US, gallium is being produced by the Eagle-Pitcher Co. who produce metal from zinc flue dusts and end residues of zinc electrolysis. Two grades are produced, both for the electronics industry and containing, respectively, less than 10 parts or less than 1 p.p.m. impurity. Another US producer is the Aluminium Company of America which manufactures from aluminate liquors obtained from the Bayer alumina process. The metal produced is also of high purity (up to 99.995 per cent).

In Germany, Otavi Minen and Eisenbahngessellschaft extract gallium, together with germanium, from zinc ore concentrates, and in France, Pechiney utilise Bayer aluminate liquors as their source.

World production is estimated at present at about 100 kilogrammes. Supply and demand are claimed to be in balance.

Various uranium extraction techniques are under investigation by the radiochemical group (see p. 715). A special contactor has been designed to allow for the direct recovery of uranium from unfiltered leach pulps by a solvent extraction technique, and natural leaching of uranium from various ores has been found to be possible.

Of great importance to the polymer industry is a knowledge of the molecular weights and molecular weight distributions of commercially important polymers. Under investigation is determination of the molecular weights and shapes of polymers by viscometry, osmometry, light-scattering photometry, and ultra centrifugation.

The programme of work on the chemistry and applications of organo-metallic and organo-metalloid compounds is now well under way (see p. 715) and some interesting electron-exchange resins have been developed.

It is obvious that the report made in January last by the chairman of the Chemistry Research Board for 1957 (*Chemistry Research 1957*) is now being fully implemented.

BID TO SAVE FTA

LAST week, Mr. Reginald Maudling, the Paymaster-General, offered to keep his Free Trade Committee in permanent session in an effort to further negotiations and to dispose of the problem of defining the origin of imports into a Free Trade Area. He stated that he was not prepared to accept any new procedural suggestions which did not offer reasonable hope of resolution before the year's end.

France asked for the committee's views on the freedom of members of an FTA to change their external tariffs unilaterally. But this question strikes at the basis of the FTA. It is believed that the 11 other countries concerned are likely to regret the thinking behind the French approach, but that there might be support for a compromise solution to make consultations precede tariff changes.

At the most recent meeting, Mr. Maudling made an important concession to the Six—their groups of experts should continue studying the rules for definition of origin by industrial sectors and should report to the Maudling Committee direct as they completed each sector. In reply to this proposal the French have suggested that the common market group should report to the OEEC steering board for trade, which has been studying these origin problems.

Mr. Maudling has been concerned to find that the principle of external tariff freedom accepted at the end of his committee's July meeting has not been upheld. He fears that European nations would prepare for a new political division of Europe if they permitted a new economic division. Should the Common Market develop without a free trade zone, it is not possible to see how the 17-nation organisation for European Economic Co-operation (OEEC) could continue to exist.

Speaking to a meeting of the Association of the West German Chemical Industry on Friday last week, Mr. Maudling said he could not imagine how under such circumstances OEEC and the entire system of unilateral trade and payments could continue. Britain could not be party to a purely European system which would subordinate the interests of her world-wide trade to its own 'narrow restrictions.' The system might offer a certain security of market but only by raising costs, a point to be regarded as a fundamental error in present circumstances. If British goods were paying a substantial duty in this European market and German goods were not, then, said Mr. Maudling, the UK would find it virtually impossible to compete. If British goods were gradually pushed out of this market, British industry would demand defensive measure, and other Western European industries would probably do likewise.

The difficult problem is the possibility of substantial disparities between the duties charged on raw materials and semi-manufactured goods (see CHEMICAL AGE, 18 October, pp. 629 and 631). Professor Hallstein, president of the Common Market Commission, has said that the future external tariff of the Common Market over the whole range of imports would be somewhat higher than present Benelux tariffs, only slightly above German tariffs and greatly below French and Italian tariffs.

UK OVERSEAS TRADE

WHILE exports of chemicals in the first nine months of this year were slightly below last year's record total, imports in the same period showed an increase. UK shipments of chemicals from January to September totalled £195.5 million compared with £200.9 million in 1957 and £179.8 million in 1956.

The Trade and Navigation Accounts for September show that in the nine months' period major export declines were experienced in the following inorganic chemicals: copper sulphate, at £1.46 million (down by £940,000); caustic soda, at £3.19 million (down by £1.1 million); soda ash, at £1.97 million (down by £340,000). On the other hand inorganic sodium compounds, at £4.27 million, were up by £170,000.

Shipments of organic acids, anhydrides and their salts and esters, at £1.2 million, showed an increase of £279,000. Exports of mineral tar and crude chemicals from coal petroleum and natural gas, at £2.2 million, were down by £750,000. The nine months' total for drugs, medicines and medicinal preparations, at £28.1 million, was £1.6 million below the 1957 figure.

Imports of all chemicals in the same period this year stood at £87.9 million, an increase of £3.7 million over 1957 and £5.7 million above the 1956 import figure. Imports of chemicals from the following sources showed the largest increases: Norway, at £2.68 million, up by £450,000; Sweden, at £2.1 million, up by £430,000; West Germany, at £15.6 million, up by £1.8 million; US, at £19.3 million, up by £1.1 million.

NCL's RESEARCH PROJECTS INSPECTED

Research Programme Concentrates on Industrial Applications

OPEN days at the National Chemical Laboratory, Teddington, held from 21 to 24 October reveal that increased effort is being given to researches of industrial importance and application, such as the extraction, concentration and purification of elements from ores and low-grade materials, the preparation of ion-exchange membranes, the synthesis of complexing resins.

Corrosion of Metals: For oxidation studies in which pressures can be controlled from less than a hundred-millionth of an atmosphere upwards, NCL's corrosion of metals group have devised and constructed an apparatus. The oxidation rate of clean pure iron is being measured by methods sensitive enough to detect the formation of less than one-tenth of a complete layer of oxide per minute.

Radiochemical Group: Research in progress in this group is on new techniques of extraction and analysis, chromatographic separations and separation of metals by ion-exchange resins and by solvent extraction.

Anion-exchange materials in sheet form can be readily prepared by reacting p.v.c. with amines. Diamines, such as hexamethylene diamine have been found to be particularly suitable yielding a product which retains the rigidity of the original p.v.c. sheet without blistering during the reaction. The anion-exchange capacity of typical material is 3.8 mequiv per g. Strong-base groups may be subsequently introduced into these membranes by reaction with dimethyl sulphate although it is not possible to convert every nitrogen atom to the quaternary salt.

These membranes have two possible uses, it is stated, in the recovery of uranium from leach liquors and pulps. In a resin-in-pulp process, it would be advantageous to use rigid, mechanically strong sheets, rather than the much weaker heterogenous membranes of the Permaplex type. Secondly, thinner sheets, which can be aminated throughout their entire thickness can be used as permselective membranes in the electrolyte cell.

Investigations have been carried out on sulphate leach liquors and on carbonate leach liquors. Uranium is preferentially transported as the anionic sulphate complex into the anolyte compartment of the cell. When leach liquors from uranium ores are used, the membranes (Permaflex A10) become poisoned, but this may be overcome by periodically reversing the polarity of the cell. A similar process is operated in the case of carbonate leach liquors and poisoning still occurs. It is believed that the uranium is probably transported as the carbonate complex $[UO_2(CO_3)_3]^{4-}$.

Direct solvent extraction of pulps is being carried out by means of the units designed by the radiochemical group. Filtration of the pulp is thereby avoided.

Uranium content of the ores under consideration is 2 to 10 lb. U_3O_8 per ton. The ore requires to be finely ground before leaching with dilute sulphuric acid.

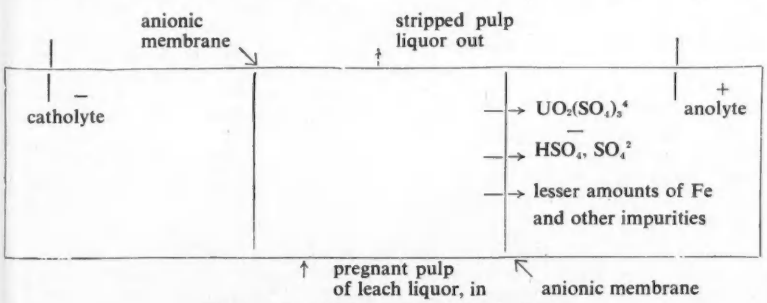
Previous attempts to treat pulps by solvent extraction in conventional equipment resulted in very high entrainment losses of solvent and the process proved unworkable on economic grounds. The NCL group have found, however, that the uranium present in the leached pulps may be extracted by a limited contact between the phases, and the disc contactor makes the use of this principle.

Leached pulp and solvent are pumped countercurrently to one another through the disc contactor unit, which consists of a cylindrical vessel in which rotate a number of discs on a central shaft. The discs are interleaved with stationary separators to reduce short circuiting of the solvent and aqueous phases. The discs are wetted by the aqueous phase and as they rotate a film of the aqueous solution is carried through the solvent, so effecting transfer of uranium.

The solvent used is a 0.1 M solution of di-(2-ethylhexyl) hydrogen phosphate in kerosene. The loaded solvent is stripped of uranium in the normal manner. The use of long chain amines as solvents has proved less satisfactory.

Blocking of the unit with settled solids does not occur, it is stated, provided the ore is finely ground and is fed to the unit at a sufficiently high percentage solids. This in turn improves the economics of the process by giving a higher solvent loading with consequent decreased strip reagent consumption. If the ore grind is suitable, solvent losses are reported to be little greater than are shown by conventional clear solution solvent extraction.

An alternative to ion-exchange for the selective concentration of uranium from clarified sulphuric acid leach liquor is solvent extraction. It is stated to offer the advantages of continuous countercurrent operation, greater flexibility to cope with changes in the feed, freedom from poisoning and mechanical blockage problems that are experienced with ion-exchange, and a smaller capital expenditure on plant. Against this must be reckoned the loss of solvent to the aqueous phase by solubility, entrainment and possibly chemical degradation; this loss will be the chief factor controlling operating costs. With extremely low-grade liquors, solvent losses per pound of recovered uranium can be uneconomically high.



Electrolytic cell for sulphate leach liquor

Solvents Required

The solvents employed for this work must be almost insoluble in aqueous solution, and in practice consist of an extractant dissolved in a cheap diluent like kerosene. The function of the extractant which may be either acidic or basic in character, is to combine with uranium and give an extractable complex. Acidic extractants include the long chain mono- and di-alkyl phosphates while basic extractants include the many types of high molecular weight secondary and tertiary amines. Amines have the advantage of a greater selectivity for uranium but suitable ones are not so readily available as the alkyl phosphates.

In practice, the solvent extraction is carried out in a multi-stage mixer-settler apparatus. Leach liquor and solvent are intimately mingled in the mixer and uranium passes into the solvent phase; the mixed phases flow into a settler where they separate out, and then move countercurrently into the mixer of the adjoining stage. The solvent becomes loaded with uranium and passes to the stripping section, comprising more mixer-settler units, where it is relieved of its uranium by contact with a stripping solution, e.g. acidified molar sodium chloride. From this, the uranium is precipitated by the addition of ammonia or magnesia. The recovered solvent is returned to the extraction circuit.

Modified cellulose as an ion exchange and chromatographic material has been studied. Sensitivity of spot tests on ordinary paper, for instance, is limited by the volume of test solution that may

be conveniently applied to a small area of the paper. By using ion-exchange cellulose, NCL investigators have found that a considerably larger volume of test solution may be allowed to drip through a restricted area, the ions all being absorbed on their passage through the thickness of the paper, which may then be tested in the normal way. In this manner the lower limit of sensitivity is reduced by a very large order.

Specimen spot tests for copper and iron were shown where they represented the number of parts per thousand million of metal (0 to 200) in the sample of water passed through a disc of cellulose phosphate. The sample solution (50 ml.), it was reported, took approximately 30 minutes to pass through the disc. Sensitivity of the spot test has been increased by a factor of 5,000 using this method.

Behaviour of Silica in Leach Solutions

The behaviour of silica in leach solutions has proved of interest. The silica has been absorbed by strong-base anion-exchange resins. It has been demonstrated that the extent to which silica is absorbed by the resin is dependent on the nature of the anions present in the system, absorption increasing from $C_{104}^- < NO_3^- < Cl^- < SO_4^{2-}$, i.e. with increase in the volume of the swollen resin in the various forms which, in general, decreases with increase in the selectivity of the resin for the anion. It is suggested that complexing of silica with the anion occurs.

Where such complexing exists to a marked degree the silica is concentrated in the resin phase together with the anion and the result of this concentration brings about polymerisation of the silica.

Generally, it is stated, poisoning of the resin is greatest with liquors containing the highest concentration of low polymer silica. Although poisoning is influenced by the nature of the polymer present, solutions containing high concentrations of low polymeric silicic acid are encountered in the acid leaching of ores containing ortho-, meta- and di-silicates. The silicic acid polymerises as the solution ages and the quantity of silica absorbed by the resin decreases accordingly. The time required for the concentration of low polymer silica to be reduced below the critical level (0.5 to 1.0g./litre) is too long for practical purposes (2 to 3 weeks). If a rapid method of inducing polymerisation could be discovered, resin poisoning could be substantially reduced.

Inorganic group: More work has been done on the use of the radioactive tracer technique in studying segregation of impurities in zone melting. For example, with silver as impurity a small amount of Ag^{110} is added; the radioactivity is measured by a Geiger counter giving the distribution of silver. By this technique purification may be obtained relatively simply and quickly. With some elements, such as silver, antimony, copper and arsnic, very small concentrations can be studied, it is announced.

An investigation of the purification of indium by zone melting has been carried out. It has been found that copper and silver may be removed with a rate of transit of the liquid zone of some 2 cm. per hour but that lead and tin do not separate to any significant extent.

Separation of rare earths by ion-exchange chromatography has continued. Head fractions of more than 99.9 per cent purity have been isolated. The partial separation of rare earths has now been scaled-up. It is reported that no difficulty has been experienced in scaling up. On large columns 15 to 20 lb. lots have been separated and on the semi-plant scale 50 lb. lots. Four or five rare earths have been obtained in quantity from the separations with some other rare earths at low levels.

For Harwell's isotope division, thulium oxide of a purity better than 99.5 per cent has been prepared. Thulium appears to have a wide potential as a portable source of X-ray, since a small amount of shielding can be used for examination of welds and in medical applications. Tin^{170} is a source of soft γ- and X-rays.

Small cylindrical pellets have been prepared by pressing and sintering (at 10 tons per sq. in. and for 1 hour at 1,600°C). Thulium can be used for testing any items in thickness/density ratio of 1 to 10 g./cm.^{2} Suitable applications are deemed to be for industrial thickeners and liquid level gauges.

Electron-Exchange Resins

Organic intermediates: Development of electron-exchange resins at the NCL is in the very early stages, German and US workers being further advanced. The laboratory is, however, using a different approach. Instead of using a hydrocarbon 'backbone', e.g. polystyrene resin or phenylformaldehyde, hydroquinones are put on to cellulose, the idea being to obtain an increased rate of reaction.

Two methods of preparation are reported by NCL: (a) by reaction of quinones containing labile halogen atoms with alkali metal derivatives of polyhydroxy compounds, e.g. reaction of sodium cellulose or sodium polyvinyl alcohol, with tetrachloroquinone or 2:5-dichlormethyl hydroquinone diacetate; or (b) by impregnation of hydrophilic materials with water-insoluble quinones. A wide range of quinones of varying redox potential can be used for this purpose, it is stated.

Applications for electron-exchange resins are: removal of O_2 from boiler water or other solutions; preparation of hydrogen peroxide, in the reduced form as polymerisation inhibitors for vinyl resins and in the oxidised form as polymerisation catalysts for vinyl monomers; as anti-stain agents in photographic emulsions; as antioxidants, e.g. prevention of peroxides in ethers; potentially useful as prophylactics for ionising radiations which are not rapidly excreted from the body (not a general application); either member of the couples I^-/I_2; $Fe(CN)_6^{4-}/Fe(CN)_6^{2-}$; Fe^{2+}/Fe^{3+}; Br^-/Br_2 can be oxidised or reduced depending on the state of the resin.

Potential applications suggested are: very selective oxidation or reduction, without contamination, of certain components of a mixture; continuous flow oxidation or reduction of organic or inorganic compounds in solution; and study of unusual or unstable valency states of certain metals.

The report for 1957 of the Chemistry Research Board and the report of the director of Chemical Research Laboratory (now National Chemical Laboratory) noted that certain aspects of the organic chemistry of boron had been selected for immediate study. Various borazole derivatives have been prepared.

Initial products of the reaction of boron trichloride and a primary amine (RNH_2) or ammonium chloride ($RNH_3\,\overline{B}Cl_4$) may be an ammonium tetrachloroborate ($\overset{+}{R}NH_3\,\overline{B}Cl_4$), $RNH_2\,BCl_3$, a 1:1 adduct, or a mixture of a tetrachloroborate and an aminoboron dichloride $RNHBCl_2$. In some cases (particularly when R is aromatic) thermal elimination of hydrogen chloride takes place quite readily, with the ultimate formation of the BBB-trichloroborazole.

$$\overset{+}{R}NH_3\,\overline{B}Cl_4 \rightarrow RNH_2BCl_2 \rightarrow RNHBCl_2 \rightarrow RNBCl \rightarrow (RNBCl)_3.$$

A more general method has been developed at NCL in which the initial product is treated in solution with a tertiary base. A number of N-substituted-B-chloroborazoles have been prepared in this way, it is reported.

Chloromethyl derivatives of boron by the diazomethane method have also been obtained. Boron compounds are effective catalysts in the decomposition of diazomethane and most efforts to prepare halomethyl compounds of boron have failed. Thus with boron trichloride, boron tribromide and phenylboron dichloride it is reported that only polymethylene is formed[1]. By working in the gaseous phase at low pressure with a very large excess of boron trifluoride, Goubeau and Rohwedder[2] have obtained fluoromethylboron difluoride.

The normal reaction has been observed to take place with BBB-trichloroborazole. For example, in ether solution at −65° BBB-tri(chloromethyl)borazole, a white solid melting point 177 to 178°, is obtained in 60 per cent yield even when the trichloroborazole is added to excess diazomethane. The infra-red absorption spectrum of this compound has shown the characteristic borazole ring absorption band at 1,485 cm.$^{-1}$

In trichloroborazoles internal co-ordination works to reduce the acceptor properties of the boron and to facilitate the migration of anionic chlorine. Thus chain growth is suppressed and the normal reaction takes place.

A note on this work will be published shortly.

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2. Goubeau and Rohwedder, *Annalen*, 1957, 604, 168.

Wain's Recent Work on Action of Copper Fungicides

CERTAIN aspects of the chemical control of plant diseases and recent work on the mode of action of copper fungicides, such as Bordeaux mixture, were considered by Professor R. L. Wain at a recent meeting of London section, Royal Institute of Chemistry.

Research by the lecturer and others had shown that the insoluble Bordeaux deposit on the leaf was rendered lethal to fungal spores by action of exudates from the spores themselves. Soluble copper so produced was shown to be in the form of complexes with amino and hydroxy acids. These complexes, stated Professor Wain, were capable of yielding the cupric ion by dissociation which could then be accumulated by the spores until a toxic concentration was reached. Such studies on mode of action are invaluable in relation to fungicidal usage.

The other important group of inorganic fungicides—those based on sulphur—were also briefly considered. Within recent years, however, most of the development had been in the field of organic fungicides. The relative advantages and disadvantages of these materials compared with the older inorganic substances were discussed and consideration was given to the basic requirements for fungicidal activity. Such factors as ability to penetrate into and move to site of action within the fungal cell and the capacity to interfere with vital processes at cell level were outlined by the speaker.

Importance of Co-operation

Importance of close co-operation between chemists and biologists in research on mode of action was stressed. Possibilities for use of organic substances as volatile fungicides were indicated and a new group of such compounds, the phenoxythiotrichloromethanes recently investigated by the lecturer and his colleagues, were described.

Recent developments in the field of systemic fungicides—that is, chemicals which are capable of conferring protection against diseases when present within plant tissues—were also considered and Professor Wain gave an account of the two-sided approach to the problem of systemic fungicidal action he and his coworkers had adopted. One such approach had arisen logically from his studies on chemical structure in relation to mode of action of plant growth substances. These investigations had led him to study a group of aryloxy and arylthio acids which, although freely absorbed by and translocated in plants, were nevertheless non-phytotoxic and did not produce undesirable growth effects. Some of these compounds, however, while possessing significant systemic fungicidal activity within the plant were found to be poor fungicides *per se* thus indicating that chemical changes occurring within the tissues are important in systemic activity.

The second approach to systemic fungicidal action adopted by Professor Wain stemmed from a consideration of natural disease resistance in plants. He pointed out that in nature such resistance was very widespread and while this could often be accounted for by morphological characteristics of the plant, such as a thick or waxy leaf epidermis, there was evidence that in many cases natural resistance had a chemical basis. Fungicidal compounds, which might play such a protective role, have been found in a number of plants, for example, Virtanen had isolated such a compound from rye seedlings and another from maize and rye plants. Both these compounds, which have been identified, possess fungicidal properties. A further example was the discovery by Professor Wain and his colleagues of an as yet unidentified antibiotic with strong antifungal properties which is present in the stem and root tissues of broad beans (*Vicia faba*).

FIRST ORDERS PLACED FOR SGB's LURGI GASIFICATION PLANT

CONSTRUCTION work on Britain's first-ever Lurgi pressure-gasification plant began on the Scottish Gas Board's site at Westfield on the border of Fife and Kinross-shire when Lord Mills, Minister of Power, cut the first turf on 24 October. The plant is to be built by Humphreys and Glasgow Ltd. at a cost of £6.6 million. The Lurgi process was described in CHEMICAL AGE, 8 March, 1958, p. 447.

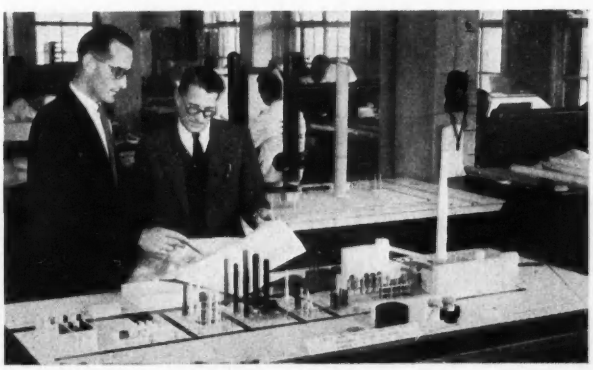
Erection is to be carried out in two stages. Stage 1, with an output of 15 million cu. ft. of gas a day, is expected to be producing gas by the autumn of 1960; stage 2 will be completed in 1962 and will provide a capacity of 30 million cu. ft. of gas a day.

Because the gas will be made at high pressure, it will be possible to pipe it through a 133-mile grid main all over industrial Scotland, without the need for compressors. Advantages of the new methods are the utilisation of low-grade opencast coal, cheapness and production of valuable chemical by by-products: tar, ammonia and benzole.

The plant will consume 350,000 tons of unwashed poor-quality opencast coal a year, material hitherto considered unusable. This will come from an adjacent opencast mine. To make the same quantity of gas in an orthodox carbonising plant would call for well over 400,000 tons of good-quality deep-mined coal. The Westfield plant will make large quantities of gas more cheaply than by any other commercial process at present in operation.

To plan the plant layout, models were used at the London headquarters of Humphreys and Glasgow. Cardboard buildings and wooden towers arranged to scale were used to represent units of material and equipment. As details became firm, a more accurate model was made. Now separate models of each section of the plant are being built on a much larger scale. These show such features as pipework, platforms and stairways and will later be taken to the site to help erection engineers.

Site is now being levelled and piledriving will start before the end of the year. Already Humphreys and Glasgow have placed orders for the first £1 million worth of material. By summer next year, engineering components will be arriving at the site and much building work complete. Total cost of the plant and associated grid will be nearly £8.5 million.

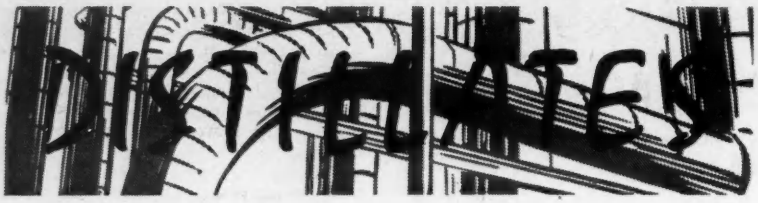


J. C. Lucas, left, and F. A. Glazebrook, of Humglas, study one of the models that will cut out much detailed drawing work on the new Lurgi plant

Methods of Identifying Food Colours Examined

Methods and techniques for the extraction and identification of colouring matter in food were critically examined in a discussion opened by Mr. P. S. Hall at a meeting of the Midlands section of the SAC on 14 October in the gas showrooms, Nottingham.

Isolation of colours by dyeing on wool was the recommended procedure, followed by identification by paper chromatography. Some suitable solvents were described and additional evidence of identification may be provided by the absorption spectrum of the unknown colour.



★ A POLYMER with what some think is a brighter future than most others is p.v.c. New uses are continually being developed for this product and some of them are featured in 'Sketches About a Mural', a new 16-mm. colour film (showing time 22 min.) produced by ICI Plastics Division. This film had its first showing to customers and the Press at the Savoy Hotel, London, last week.

It portrays the discovery of p.v.c. in 1838 by the young French chemist, Henri Regnault and its commercial development many years later. Now 800,000 tons are produced each year throughout the world; UK production rose from 30,000 tons in 1953 to more than 60,000 tons last year.

The film does not aim to illustrate the chain of processes linking vinyl chloride gas with p.v.c. compounds nor to discuss methods of manufacture, but it shows the dramatic and vital end uses of the material in some of the major UK industries. Some of the scenes were shot in the Plastics Division laboratories to show how research workers are constantly seeking to produce new grades and to widen the properties and end uses of the polymer.

★ ABCM chairman's reference at the annual meeting (CA, 18 October, p. 633) that the Import Duties Act 1958 will from 1 January next replace the existing UK Tariff with the Brussels Nomenclature reminds me that many of my readers, particularly those in the merchant trade, may probably not be familiar with the Brussels Nomenclature.

This new procedure is not nearly so formidable as the official title might suggest. In effect it will greatly simplify the work of those involved in the export and import of chemicals. As a further aid to the industry, manufacturing and merchanting alike, HM Commissioners of Customs and Excise have published through the Stationery Office a useful guide entitled 'Classification of Chemicals in the Brussels Nomenclature.'

Available from the Stationery Office, price 8s 6d net, it provides an invaluable cross reference to the Customs and Excise Tariff, which is also now available price 12s 6d. The booklet contains an alphabetical list of chemicals against the numbers of the headings under which they are classified in the Brussels Nomenclature and the UK Tariff. The rate of duty chargeable on the chemicals can be ascertained from the Tariff.

Although not comprehensive, the list includes most of the principal chemicals of commercial importance. It shows the classification of chemicals as such and does not indicate their classification when mixed or when, for example, they are put up for retail sale. Synthetic organic dyestuffs, generally classified under heading 32.05 are not included. The system of chemical nomenclature used in the list is based on that described in BS 2474/1954.

★ THE 10 years when chemical analysis passed from the sphere of the dilettante chemical investigator to that of an exact science, capable of legal argument and applicable on an industrial scale, are covered by the earliest 10 volumes of *The Analyst*. I now learn that these volumes, covering the years 1876 to 1885, have been republished in facsimile form by W. Heffer and Sons, Cambridge, who are the current publishers of the journal for the Society for Analytical Chemistry. US publication is through the Johnson Reprint Corporation.

During these years the analysis of water was systematised and the beginnings of biological examination are described in many of the papers published in the volumes. Because they also cover the early years of the operation of the Sale of Food and Drugs Act, 1875, they are of considerable historical importance.

Each volume is available separately at 6 gn. net, bound in cloth boards in the style of the original. It is notable that the SAC, or the Society of Public Analysts as it was then known, has from its inception catered for all classes of analyst. Volume 1, for instance, contains papers on the analysis of coal and of plating and gilding solutions, as well as much work on various foods.

★ How scientists not only helped create and discover a potent weedkiller, 18-15, but had also played a leading role in the subsequent sales drive to the ultimate consumer was described by Mr. R. M. Mellhuish, joint managing director, Fisons Pest Control Ltd., recently. Mr. Mellhuish was presenting a paper at a conference of the Incorporated Sales Managers' Association.

Discovery of 18-15 gave the company a very much more versatile chemical weedkiller than MCPA, but it was decided to shorten the normal development period of three to five seasons to two seasons only. The product was discovered in May 1956 and was marketed in the spring of 1958.

Scientists played a vital part in marketing. Initial demonstrations on selected farms were carried out not by salesmen but by chemists and technicians. Although all the normal sales methods were used in the launching campaign the keystone was personal selling to groups of farmers which was done by the research team. During last winter teams of salesmen and scientists visited all agricultural centres giving film lectures. It is obvious that this new product would not have reached the market this year if the research team had not taken an active part in promoting it.

★ A FORCEFUL reminder of how easily spillages can occur when tankers are emptied, despite stringent precautions, reaches me from a northern court reporter. In Huddersfield West Riding Court last week, Laporte Acids were fined £10 for using a lorry with defective bolts to secure a tank.

The prosecution alleged that only seven bolts held a 1,000 gall. tank of acid to the lorry. When the lorry took a bend, the tank rolled off and acid was spilled over the road. No injuries or other damage resulted. It was stated that 37 of the 44 bolts which should have held the tank on the lorry had either corroded or rusted away.

Appearing for the company, which pleaded 'Guilty', Mr. C. W. Nelson explained that the week before the accident, a considerable quantity of nitric acid had been spilled over the lorry. Although the vehicle was washed down there had apparently been some corrosion. Mr. Nelson added that the driver, who had more than 40 years' experience, should have inspected the 10-ton lorry.

★ ALTHOUGH recent investigations have shown that a great deal is known about distillation there is a demand for additional information to fill gaps in present knowledge of the subject. With this in mind the Institution of Chemical Engineers and the chemical engineering group, Society of Chemical Industry, are sponsoring an international symposium on distillation which will be held in England in the spring of 1960.

Subjects to be covered will be: Fundamentals (theory)—vapour-liquid equilibria; mass and heat transfer: Fundamentals (practice)—hydrodynamics of distillation apparatus; prediction of plant efficiencies: Plant—comparative performance of tray columns; correlation of performance of packed and other columns. Summaries of papers for consideration should be sent to the institution at 16 Belgrave Square, London SW1, before 1 June next.

It was the lack of knowledge on this subject that led the Association of British Chemical Manufacturers and the British Chemical Plant Manufacturers' Association to set up last year a joint research panel on distillation. As a result nine universities have agreed to carry out a three-year programme on six research projects at a cost of £10,000 a year.

Alembic

IMPROVED SULPHURIC ACID CONVERSION IN CONTACT PLANT BY AIR DILUTION

PRIOR to the last war, references were made to the advantages that should follow the use of inter-stage dilution with cold SO_2. A US patent (USP 2,104,858/1935, R. B. Ferguson) covered the design of a very complicated equipment for the introduction of cool SO_2 between stages and for thorough mixing of the hot and cool gases. The possibility of also using the same device for cold air dilution was also clearly stated. After reviewing suggestions regarding air-dilution in a paper delivered before a meeting in London of the Fertiliser Society on 30 October, W. N. Hackett and Dr. R. W. Riding gave an account of nine years' successful operation of air dilution on the sulphur-burning plant at Oldbury. The conversion of this contact sulphuric acid plant they reported had enabled a 20-year old plant to approach very closely to the requirements for a post-war four-stage plant while being still basically a two-stage unit with only relatively inexpensive modifications.

Development

This project was begun about 1940 when a report on an 'ideal' sulphur burning contact plant was produced by Dr. Riding and W. H. Palmer. Among the novel suggestions made was that, starting with a very strong gas, by progressive dilution with cold air between the various catalyst layers, the costly and by no means trouble-free heat exchangers could be dispensed with.

At the end of the war the contact plant at Oldbury—a two-converter unit—was working at its rated capacity of 50 tons of monohydrate a day. During the next four years demand increased considerably. The blower was working flat out and to obtain greater output the gas strength was increased to such an extent, in fact, that conversion fell and the acidity of the exit rose until comment was attracted from the Alkali Works Inspector. The economic limit was also at hand. Addition to a third converter was not possible due to the space available but there was a possibility that a third converter could be inserted under the second with a heat exchanger alongside. Interstage dilution was therefore considered.

Calculations showed that there would be little advantage in introducing dilution between the catalyst layers of the second converter. It was possible, however, to split the single catalyst layer of the first converter into two with enough space in between for the dilution equipment. No identifiable trouble was caused by the top of the catalyst coming right up to the beginning of the dished top of the vessel.

As there was no spare blower capacity, a separate dry air supply was necessary in order to keep initial SO_2 concentration as low as deemed desirable. The dilution range envisaged was 1,000 to 2,000 cu. metres of air an hour, with a pressure of at least 50 in. W.G.

Because of the difficulty of obtaining suitable equipment, cold dry air from the drying towers (situated downstream from the blowers) was diverted to the dilution point, and the initial SO_2 concentration was allowed to rise to 8 to 10 per cent with consequent increase in burner temperature.

It was thought that the point of junction between the cold air and the hot partly converted gas might be an area of severe corrosion. The nozzles were therefore made in mild steel and lasted for six months. To ensure enough turbulence, air velocity was kept high, with consequent pressure drop. Six 3 in. diameter pipes coming off a ring main entered the converter approximately radially. The inner ends of the pipes were blind and on each side of each pipe there were eight holes ½ in. diameter projecting the air horizontally. At first produced in mild steel, these pipes were succeeded by cast iron pipes with 11/16 in. diameter holes.

Pyrometers were positioned, one as low as possible in the top layer of mass just above the support and the other was placed so that it was just submerged in the bottom layer. Temperatures were found to be considerably influenced by changes in the design of dilution nozzles used. Of importance was standardisation of the distance that the couples project into the converter.

Start-up of Plant

This modified plant was started up in March 1949; 3,500 lb. of mass in the top layer and 5,500 lb. in the bottom layer. After four days dilution air equivalent to 2.5 per cent of the total blown volume was introduced and the first mass inlet was raised from 410° to 415°C. After a further two or three days, the dilution was raised to 5 per cent with an inlet of 420°C and soon after to 7.5 per cent with 430°C inlet. After varying gas strengths, the increase of dilution was resumed with the results noted in Table I.

By August the spread across the top layer of the first mass had fallen to 100 to 110°C and that across the bottom layer had risen to 65° to 70°C but no material falling off in conversion was found; 12 per cent dilution was the practical limit available at this time.

To increase the amount of dilution the most obvious thing to do was to increase the size of the air holes in the nozzles. These were removed in October when it was found that they were considerably corroded, particularly at the edge where the air met the main gas stream. Sulphate had formed and blocked the innermost holes, thus considerably impairing the cooling efficiency. With the use of the cast iron nozzles, considerable variations of dilution proved to be possible.

TABLE I

Gas Strength 8.2 to 8.45% SO_2 (corrected for dilution)

1st Converter		Dilution	%	10		12
	Top	In	°C	430		435
		Spread	°C		105	121
		Out	°C	535		556
	Bottom	In	°C	483		487
		Spread	°C		65	60
		Out	°C	548		541
		Conversion	%	78.9		80.2
2nd Converter		In	°C	430		430
		Spread	°C		29	25
		Out	°C	459		455
		Conversion	%	96.6		96.8
		Chimney, gas	SO_2/ft³	4.0		4.0
		Conversion at stock		97.1		97.3

From readings taken over a 48-hour period, it is noted that in the case of the first mass, conversion rises with increasing dilution to a maximum and then falls away because, it is presumed, the lower layer is cooled down excessively. If the sole criterion were conversion efficiency the best dilution, Hackett and Riding stated, would be between 17 and 22 per cent but even with the modified air nozzles 16 per cent would be a practical maximum at normal loads and 14 per cent a more useful figure to work at.

These results led to consideration of the introduction of dilution air into the second converter. Placing of the air jets was found to be simpler than in the first vessel. The dilution air supply was again drawn from the main gas stream. The main difficulty with air dilution in the second converter proved to be in the interpretation of the results.

Introduction of cold dilution air between the layers in the second converter gave only a marginal improvement in overall conversion (97 to 98 per cent) when the first mass conversion was 80 per cent or more. With 77 to 80 per cent the improvement was measurable at 0.1 to 0.2 per cent: with a lower first conversion the advantage could be expected to be greater. In this present instance, the total effect was an increase in conversion of about 1½ per cent so that the plant now has a margin of safety. Air dilution, Hackett and Riding feel, may provide just that extra little bit of conversion efficiency necessary to get the plant out of difficulty and remove the strain of working without a safety margin. It is believed, also, that air dilution in the second mass may prove to be a definite advantage when the first mass conversion is falling off and may enable the sieving or renewal of the mass to be delayed.

Donations to University of Leeds

The following donations have been received by the University of Leeds: £1,500 from the Royal Society for the inorganic and structural chemistry department; £700 a year for three years from the Wellcome Trust for a research assistant in the biochemistry department; and a dyeometer from Ciba Clayton Ltd. for the colour chemistry and dyeing department.

Analytical Review

Potentialities of Liquid Amalgams as Reagents

By T. S. West, Ph.D.

This month's article is devoted to the review of a recent paper on the use of liquid amalgams for for the analysis of reducible substances, organic and inorganic. Combination of this valuable reduction technique with the versatile EDTA procedure for the titration of metal ions has presented the analyst with a useful new method.

THE use of liquid amalgams in analytical chemistry is well known, and extensive reviews have been made which summarise the applications and limitations of such procedures[1-3]. As always, the principle is based on the reduction by a suitable amalgam of the substance being investigated and determination of the reduced substance formed in solution, or determination of the oxidation product of the amalgam liberated into the solution.

$$M(Hg)_x + Ox \rightleftharpoons Red + M^{+n} + Hg^{\circ}$$

Amalgam + Sample → Reduced Form + Metal Ion + Hg

In some cases, of course, the reduced form may dissolve in the excess amalgam and the only possibility for analysis is to determine the liberated metal ion unless resource is had to tedious analysis of the amalgam itself.

In instances where ions such as tin IV, iron III, etc., are being reduced by a zinc amalgam, oxidimetric titration of the tin II or iron II so formed provides an excellent means of determination since the liberated zinc ions do not interfere. Tin amalgam is unique in that it liberates a reducing ion (Sn II) and while this causes complications in the analysis of the above-mentioned ions, it is useful where the test ion is reduced to zero valency. Nitro compounds have been determined by bromometric titration of the amines formed by amalgam reduction.

EDTA Titration

Scribner and Reilley[4] have recently published what is considered by the author to be a most significant paper in which they have ingeniously made use of the ease with which most metal ions can be titrated with ethylenediamine tetraacetic acid and the liberation of such ions from liquid amalgams in reduction procedures such as those described above. Their approach to the problem is a model of scientific method and one which will repay close study by all young research workers.

They show how the appropriate amalgam must be chosen so that its reduction potential is sufficiently low to reduce the ion under test, but not low enough to reduce the solvent molecules ($H_2O \rightarrow H_2$) and thus give rise to spurious results. Furthermore, judicious selection of the amalgam ion may permit the determination of one reducible substance in the presence of others because of variation in reducing power. Control of pH, etc., may also affect the oxidation potential of the system and permit suitable control for multi-stage reductions. Published data for half-wave potentials of metal ions or amalgams and of the test ion furnish a suitable guide to the selection. The amount of amalgam used must be such that there is no great percentage change in the activity of the metal ion in the amalgam at the end of the reaction.

The presence of complexing agents has a considerable influence on the course of amalgam reductions. This is illustrated by reference to the reduction of silver by mercury in the presence of several complex formers. The complexing agent may, of course, affect the potential of both amalgam and the ion being determined so that considerable effects can be derived from such experiments.

The rate of reduction is another feature which receives attention from Scribner and Reilley. The close similarity between amalgam reduction and controlled-potential coulometry is stressed and it is indicated that the amalgam method usually requires much less time than the other technique.

The applications of the EDTA-amalgam reduction method to the analysis of cations and mixtures of cations may be classified as follows.

(1) Exchange of a metal which is easily complexed for one which is not.
(2) Exchange of a metal which cannot be complexed for one which can.
(3) Analysis based on differences in equivalent weights for reduction and complexometric titration.
(4) Analysis of species not amenable to direct complexometric titration.

Examples of these are as follows:

(1) Consider a mixture of a difficult-to-mask (but reducible) ion such as Pb and a non-reducible ion, e.g., Mn. The total of Pb + Mn can be determined complexometrically. In another aliquot (de-oxygenated) the lead is exchanged for zinc by means of zinc amalgam; the zinc is masked with cyanide and the manganese ion determined by EDTA titration.

(2) Both copper and nickel are masked by cyanide ion, but the mixture can be resolved if one of them is reduced with an amalgam and replaced by an equivalent amount of a third metal which is not masked by cyanide. A suitable reagent is therefore lead amalgam which replaces the copper by lead.

(3) Consider a mixture of bismuth and lead. Both react with EDTA with an equivalence of 1 : 1. Reduction with a zinc amalgam gives an amount of zinc in solution equal to 1.5 times the molar amount of bismuth (3-electron transfer) plus an amount of zinc corresponding to the molar concentration of lead (2-electron transfer). Thus if the two EDTA titres are designated T_1 and T_2, there are two simultaneous equations:

$$[Bi^{3+}] + [Pb^{2+}] = T_1$$
$$1.5\ [Bi^{3+}] + [Pb^{2+}] = T_2$$

which can be solved for the molar concentration of lead and bismuth in the mixture. The procedure can, of course, be modified to deal with three-component systems such as bismuth-lead-cadmium, etc.

Reduction of Ions

(4) Reduction of ions such as chromate and permanganate yield ions which can be titrated with EDTA as well as the ion from the amalgam. In such instances, masking reactions may be used or the principle described in the previous paragraph. If, however, the non-titratable metal ion, e.g., Tl (I), is reduced to zero valency state then there is no difficulty in determining the ion transferred to the aqueous solution from the amalgam.

Indirect Complexometric Titration. Many reducible organic compounds can be determined indirectly by EDTA titration of the metal ion liberated from the amalgam during reduction. Thus maleic acid was reduced to succinic acid by zinc amalgam and the zinc ions titrated with EDTA in the usual way. *p*-Nitrophenol was determined similarly. The reduced solution turns yellow on exposure to air, but there is little interference with the end-point if the zinc is titrated immediately after reduction. Similarly, 2,4-dinitrotoluene was reduced to 2,4-diaminotoluene by zinc amalgam. No trouble was experienced with the visual end-point when the concentration of dinitrotoluene was less than 25 mg./ml. 2,4,6-Trinitrocresol was determined similarly. The yellow-orange solution resulting from the reduction caused the colour change of the Eriochrome Black T indicator to be from red-orange to green rather than red to blue. Excellent results were also obtained for picric acid, *p*-benzoquinone and benzil.

Choice of Amalgam and Medium. The polarographic half-wave potentials for organic compounds indicate that the number of organic functional groups which can be reduced by zinc amalgam is limited. This feature, however, can be used for the selective reduction and determination of one substance in the presence of others. Thus benzil can be determined in the presence of benzoin by means of a zinc amalgam in an acetate buffer medium.

Scribner and Reilley made attempts to use barium amalgam since this, theoreti-

(*Continued on page* 725)

MINISTRY BATTERY SYMPOSIUM

Construction and Performance of Kalium Mercury Cell

DEVELOPMENT of the Kalium mercury cell was outlined by G. Matthews, Burndept Ltd., Dundee, Angus. Important features in construction of this cell were: The zinc canister which took no part in the discharge reaction and was merely a container; the anode of granular zinc layered on to Whatman paper; mercuric oxide/carbon cathodes with the carbon rod current collector; the inner seal comprising a washer of resin-impregnated board with a neoprene-based adhesive on top of it; the p.v.c. sleeve around the outside of the can, which is tucked into the top of the cell prior to closing; and the final seal made by swaging the canister on to a polythene washer. This cell construction has been used on cells ranging from 0.30 in. to 0.75 in. diameter and of capacity range from 125 m.amp. hours to 4,000 m.amp. hours. Variation within a batch of cells is stated to be less than a millivolt standard deviation. The decline in open cell voltage is of the order of 5 m.volts per year.

Cathode performance has been found to be unchanged, Matthews reported, after prolonged periods of tropical and temperature storage. The anode, composed of zinc granules mounted on Whatman paper by means of starch or other suitable material, was stated to be the unique feature of the Kalium cell, and from which most of the advantages of performance were derived. Mesh size of the granulated zinc was carefully controlled (in the range 60 to 200 mesh) as was particle size (to provide sufficient surface area to maintain current density. The effect of particle size on cell performance could be most striking, especially at 0°C where, for example, 50 per cent increase in duration could be achieved by the use of zinc of approximately 120 mesh as against zinc of approximately 80 mesh.

To counteract the increased tendency to gassing (hydrogen gas from solution of zinc in potassium hydroxide), the zinc was amalgamated. Electrolyte formulation was a compromise between maximum performance and maximum stability and was a solution of about 40 per cent KOH with an appreciable quantity of zinc oxide incorporated as potassium zincate.

A range of cells had been developed, reported Matthews, having the property of giving high watt hours per cubic inch and, if required, high voltages per cubic inch. The smallest cell developed to date had a volume of 0.08 cu. in., was available with a 0.28 watt hour capacity and was capable of giving up to 100 m. amp. continuous current drain. It was not considered by any means to be the ultimate in the Kalium design potential.

During the last 18 months, the diversity of use of the Kalium cell had increased greatly. For guided weapon telemetry, units had been produced, some of which comprised hundreds of cells coupled in series parallel and provided with internal thermostatically controlled heating systems, foamed-resin cases, etc.

Summarised here is a selection of the papers presented at the Symposium on Batteries, Signals Research and Development Establishment of the Ministry of Supply, Christchurch, Hampshire, October, 21 to 23.

Further development was being concentrated in three main channels, the first of which was to produce a cell with increased capacity/volume ratio. To this end Burndept's were now producing cells with a 50 per cent increase over their counterparts in their existing range, and these new cells were mainly intended for transistor use where the current requirements were small. For the second, work was being concentrated on the necessity to give high-capacity cells in a small volume by use of a layer technique. So far 15 volts had been achieved with a capacity of 3.7 watt hours per cubic inch. The third project, under the auspices of the Ministry of Supply, was the use of magnesium cans instead of zinc as the outer case. Advantages to be derived from this were that magnesium was inert to electrolyte and therefore would not corrode on long-term storage and it also enabled a considerable weight saving to be made.

The Kalium system of mercury cell was considered by Matthews to be capable of considerable development which would enable it to increase its part in the field of primary developments.

Lead-Tin-Barium Alloys for Grids

ALTHOUGH small additions of barium or calcium imparted stiffness and creep strength to lead castings, a series of experiments by N. L. Parr, A. Muscott and A. J. Crocker, Admiralty Materials Laboratory, Poole, Dorset, led to the conclusion that such castings for the grids of lead acid batteries would be susceptible to rapid anodic stress corrosion at grain boundaries unless enough tin were present.

The precise tin content is critical—if too much were present it would lead to general thinning. The experiments had indicated 3 to 3.5 per cent of tin would be a suitable addition to 0.1 per cent barium alloy. Should this barium content be exceeded there is danger of reintroducing intergranular attack but a content of less than 0.07 per cent would reduce grid stiffening during pasting. Creep resistance would still be adequate down to 0.05 per cent barium.

Lead-tin-calcium alloys showed a similar relationship but no composition in the series which was resistant to intergranular oxidation was free from the effect of general thinning.

Anodic corrosion tests in the laboratory had indicated that cast lead-tin-calcium alloys were characterised by the formation of a tenacious oxide layer which, because of its interdendritic attachment to the parent alloy, should promote good contact between paste and grid. These alloys also showed promise of freedom from 'mossing' and their relative corrosion resistance was unimpaired by the added influence of high stress.

Full-scale trials of a 3 to 3.5 per cent tin/0.07 to 0.1 per cent barium/lead alloy under service conditions are now being undertaken and it is considered that the alloy has good potentialities as a new grid material for lead acid batteries having longer service life.

Evolution of Stibine from Batteries

AFTER warning of the dangers of stibine[1] and of the ease with which it can be formed by electrolysis[2-6], Dr. R. Holland, Admiralty Engineering Lab., gave methods of its estimation in charge cases.

Special analytical techniques must be developed because the high toxicity of the gas made detection of extremely small amounts important. Qualitatively, the most sensitive test, in the absence of interfering gases, was the silver nitrate test. Haring and Compton[4] based their method on the reaction of stibine with iodine, the rate of loss of which gave an absolute measure of the stibine content without any calibration.

Of the more reliable methods based on direct estimation of antimony, that of Webster and Fairhall[7] is most commonly used. McChesney[8] had developed a colorimetric micromethod for estimation of antimony in biological materials and

Dr. Holland used the same principle in his estimation of stibine evolved from lead acid batteries.

The gas was bubbled through a solution containing 1 per cent by weight of iodine, 8 per cent by weight of KI and 8 per cent by volume of conc. H_2SO_4. Excess solid sodium hypophosphite was added to the sample immediately on collection, thus clearing the iodine within 10 to 20 min. The optical absorption of the solution was measured at 4,250 Å in a spectrophotometer and by comparison with a calibrated curve, the antimony content, and thus the stibine absorbed, could be measured over the range 1 to 70 p.p.m. by weight in the absorbing solution.

Measurements on Lead Acid Cells

Advantage was taken of a life test being conducted on two cells of several thousand ampere-hours' capacity. The positive grids of one cell were cast in 8 per cent antimonial lead and those of the other cell contained 3 per cent antimony with some tin and selenium.

The cells were worked on a routine of one cycle of discharge and charge per week in a water-bath maintained at 100°F. No measurable amounts of stibine were evolved during discharge or while the cells were on open circuit, nor could significant amounts be detected during charge until overcharge began. The evolution rate rose rapidly at the commencement of overcharge and coincided with the voltage rise, and, after passing through a maximum, fell off. During the first two and a half years the stibine evolution rates changed very little and it is noteworthy that the cell with 8 per cent antimonial alloy grids had a rate five times that of the other cell. Long-term accumulation of antimony poisoning seemed to have little direct effect in stibine formation, only recently deposited material being effective.

Whether or not stibine in the gases evolved from lead acid cells would constitute a hazard would depend largely on the volume of the confining space and the degree of ventilation. These factors were controlled by the user who might be expected to prevent the accumulation of explosive quantities of hydrogen, but as hydrogen diffuses eight times as fast as stibine prolonged working in a confined space where cells are charged should be avoided.

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High Temperature Carbonate Fuel Cells for Industrial Gases

WORK instituted by the Ministry of Power on the development of high temperature gas fuel cells was reported by C. G. Conway (Ministry of Power) and Dr. H. H. Chambers (Sondes Place Research Institute). The aim of the work was to develop a cell which would operate at temperatures of the order of 600°C and give a sufficiently high current density to enable a practical unit to be engineered and demonstrated (see CHEMICAL AGE, 19 July, p. 105).

Preliminary investigations showed that use of iron and iron oxides as electrodes was unsatisfactory since the composition electrode tended to stabilise after running the cell for some time and the electrolyte was attacked. Use of iron also encouraged deposition of carbon from carbon monoxide unless the temperature was above 700°C. Electrode connections and holders of austenitic stainless steel were found to prevent this by giving a surface which was not rich enough in ferric oxide to catalyse the reaction. Finally a silverised zinc oxide electrode was chosen. With this type of electrode and a eutectic mixture of sodium and lithium carbonates as electrolyte, deposition of carbon is avoided. The carbonate electrolyte is maintained in a stable condition by feeding CO_2 with oxygen or air to the oxygen electrode in proportion of two moles of CO_2 to one of oxygen

Construction of cells to build up a composite battery is stated to depend on the practical difficulties of feeding gas and air to the respective electrodes; providing an extended area of electrode surface with good electrical connections; and electrolyte with a high conductivity which is contained in the cell holder. As a result of investigation of these difficulties, a battery cell has been designed with a 2½ kW output. Main hindrance to output proved to be the internal resistance of the cell. For a given electrolyte, it is important, Conway and Chambers state, to attain the smallest electrode spacing compatible with safety and reliability in operation. One method of separation has been to impregnate a porous disc of sintered magnesia, and as a further development of this technique the electrode is a layer sprayed on to each face of the disc.

Terminal voltage is determined by the exit gas composition and the internal resistance. No significant polarisation occurs if the reaction is taken to completion, it was stated. The energy loss which occurs unavoidably if the full amount—namely 97 per cent, which is the maximum useful percentage—of fuel consumption is used in one pass, can be almost completely eliminated if several cells are operated in one cascade.

The type of cell described by Conway and Chambers has been operated on hydrogen, carbon monoxide, methane and paraffin vapour. It has also proved possible to oxidise certain organic chemicals such as methanol to intermediate stages by control of the terminal voltage. There is therefore a possibility that such a cell could be used for controlled chemical reactions.

Search has been made for suitable electrolytes which remain stable without feeding CO_2 to the oxygen electrode. Solutions of oxides that are poor ionic conductors in fluorides are reported as having shown promise with higher outputs than the carbonate cell.

Different Grades of Manganese Dioxide in Depolariser Mix

THE comparative performance of natural, chemically actuated and electrolytic manganese dioxide in the depolariser mix of dry cells, including storageability was described by F. M. Booth, Signals Research and Development Establishment (SRDE), Christchurch, Hants. Batteries were manufactured using natural manganese dioxide in the depolariser; 'chemically activated' manganese dioxide and electrolytically produced manganese dioxide.

According to Booth the shelf life of layer stacks was not determined by the type of MnO_2 used. The LT sections of all batteries, regardless of manufacturer, or type MnO_2 used, gave good shelf life even up to the maximum period of storage reported of four years. The tests showed that, properly formulated, natural MnO_2 could give surprisingly high capacities, the 'chemically activated' MnO_2, natural ore subjected to chemical processes, had increased activity up to 20 per cent more, while the synthetic electrolytically produced MnO_2 was capable of giving discharge lines of double (or even more) the capacity obtained from natural MnO_2.

Use of electrolytic MnO_2 in batteries is governed principally by the cost factor which, it has been stated, may be up to four times that of natural MnO_2.

Of interest to SRDE have been test results obtained with WB4100 batteries which were specified to have a minimum initial life of 16 hours with reduced life after various periods of storage. In some recent series of tests, the discharge of the LT sections have been continued down to more realistic points (to 1.1 volts and 1.0 volts as well as the specified 1.2 volts). HT sections, composed of a number of layer stacks, were found to have a useful shelf life of up to 78 weeks on the average and, in some instances, up to two years.

Booth expressed the view, however, that the layer-stack, as used in the HT sections, whatever the type of MnO_2, was not adequate for the reliability demanded of Service batteries. Therefore, for Service batteries, an all-round cell battery gave the better result.

Grant to SAC

For the next three years the SAC will receive £100 from the Dunlop Rubber Co.

STRUCTURE AND DRUG ACTIVITY—7

Parasiticides and Pesticides

By
Peter Cooper,
F.P.S., F.C.S.

AS antimalarials, the naturally occurring cinchona alkaloids have largely given way to synthetic drugs hardly less complicated in structure. Most of these possess a basic aminoalkylamino side-chain attached to a heterocyclic nucleus such as quinoline, acridine or benzoxazine. Some aminopyrimidines or guanidino-pyrimidines also offer active derivatives.

Mepacrine, the only common acridine drug is its 2-chloro-5-(4-diethylamino-1-methybutylaming)-7-methoxy derivative. It is rather too toxic, and often causes gastro-intestinal irritation, skin reactions, central nervous excitement or anaemia. No other satisfactory acridine antimalarial has appeared. The aminoalkyl side-chain is important to activity, the lower homologues increasing in toxicity; four carbon atoms give the highest potency in the series. A related compound, 3-chloro-7-methoxy-9-(2-hydroxy-3-diethylamino) propylamino-acridine, has shown considerable potency in cases of giardiasis. The racemic form of mepacrine differs little in potency from the dextrorotatory form.

Research into Quinolines

Research into the quinolines has produced less toxic drugs based on 4-amino- or 8-amino-quinoline. The antimalarials in the first series are chloroquine, 7-chloro-(4- - diethylamino - 1 -methylbutylamino) quinoline, its 4-hydroxy derivative, and amodiaquine, 7-chloro-4-(3-diethylamino-ethyl-4-hydroxyanilino) quinoline. Chlorine in position 7 of the 4-aminoquinolines is most effective, and the dextro-isomers are said to be less toxic than the laevo ones. The effect of hydroxylation of one ethyl group of the side-chain amino of chloroquine is to reduce its acute toxicity to one-fifth, and to eliminate the long-term toxic effect upon blood-cells which occasionally accompanies chloroquine treatment. This makes it possible safely to double the clinical dosage. The aromatic group introduced into the side-chain of amodiaquine seems to predispose towards blood disorders in some individuals, though its activity and acute toxicity differ little from those of chloroquine.

In one respect the 8-diethylamino derivatives of quinoline differ from the 4-dialkyoamino compounds; they are both schizocidal and gametocidal towards the malaria parasite, whereas the 4-dialkyl derivatives are only schizocidal. Pamaquin, 8-(4-diethylamino-1-methylbutylamino)-6-methoxyquinoline, has a fairly narrow margin of safety between therapeutic and toxic doses. Any branching of the diethylaminoalkyl side-chain, except at the alpha group, narrows the margin still further. For maximal effectiveness combined with minimal toxicity, the terminal group should be diethylamino or dipropylamino; the 6-methoxy component is essential for potency.

Pentaquine, the corresponding 5-isopropylaminopentylamino drug, has a lower toxocity than pamaquine. The isomer of pentaquine, isopentaquine, 8-(4-isopropylamino - 1 - methylbutylamino) -6- methoxyquinoline, is equally effective against malaria, these two compounds being roughly twenty times as potent weight for weight as quinine itself. In primaquine 8- (4-amino-1-methylbutylamino) -6- methoxyquinoline, the terminal amino group of the side-chain remains unsubstituted. This drug is more active, and in ordinary therapeutic doses less toxic, than pamaquine; unfortunately, when used alone, it is effective only against the gametocytes of malaria.

The 2-aminopyrimidines are antimalarial, their effectiveness being greatly enhanced by the introduction of a guanidine grouping in conjunction with pyrimidine. p-Chlorophenyl-2-(4-methyl-6-diethylaminoethylaminopyrimidyl) guanidine is very potent, and offers support to the hypothesis that antimalarial activity in these compound depends upon tautomerism in the molecule. Opening the pyrimidine cycle produces another series of compounds, the biguanides, of which proguanil, N-(p-chlorophenyl)-N-isopropylbigaunide is the safest clinically. Homologues with a 5-alkyl group have been prepared, and retain activity, but increase in toxicity. Dihalogenation in positions 3 and 4 of the phenyl ring will enhance the activity of the series, but no clinically safe compound has emerged.

Diaminopyrimidines are of interest because of their relationship to metabolites of the biguanides. They are folic acid inhibitors, and therefore rather toxic in general. Pyrimethamine, 2,4-diamino-5-(p-chlorophenyl) -6- ethylpyrimidine, has superior potency as a plasmodocide and has been widely used clinically, but its tendency to cause anaemias discourages its further use as a routine antimalarial.

A number of drugs used against amoebic infestation appear to depend upon their chelating action upon essential metals concerned with the parasite's metabolism. Among them are the halogen derivatives of 8-hydroxyquinoline. The earliest was chiniofon, 8-hydroxy-7-iodoquinoline-5-sulphonic acid, and was improved by further iodination and desulphonation. Iodination in the 5 position gives diiodohydroxyquinoline, probably the most valuable drug against *Endamoeba histolytica*. Other halogens are effective in the quinoline series; 5-chlorination of chiniofon yields iodochlorhydroxyquinoline, a drug which has enjoyed some vogue in treating all manner of dysenteric states. Alkylation of the quinoline structure at position 2 greatly weakens antiamoebic power, though the antiseptic potency is retained; 5,7-dichloro-8-hydroxyquinaldine has uses as a skin antiseptic but not as a parasiticide. A recently developed phenanthroline derivative, also with potential chelating power, has proved relatively safe and very active against amoebic infestation; this is 4,7-phenanthroline-5,6-quinone, and from the clinical angle its freedom from halogen atoms promises safety during long-protracted treatment.

The chlorinated hydrocarbons have long been used as anthelmintics, but there is no simple relationship between their structure and potency against intestinal worms. No progressive increase in potency occurs with increase of molecular weight in the primary monohalogenated compounds, although there is an upward trend in activity in the secondary series. In the primary dihalogenated compounds increased potency follows increased molecular weight when the halogen occurs in the terminal group. An increase in the number of halogen atoms in the molecule does not necessarily potentiate the drugs, and their isomers differ widely in activity. Low water-solubility is a deciding factor in determining potency. Chlorinated compounds with solubilities between 1 in 5,300 and 1 in 1,250 are usefully active; but as the solubility approaches 1 in 1,000 a sharp drop of potency occurs. Brominated and iodinated compounds are anthelmintic over the range of solubility 1 in 1,700 to 1 in 1,000 but they are all extremely irritant to mucous membranes and therefore too toxic to be used internally. In practice, the choice lies only between carbon tetrachloride and tetrachloroethylene, the second being the drug least likely to cause serious toxic effects.

Piperazine as Anthelmintic

An almost non-toxic drug, piperazine (which nonetheless sometimes causes hypersensitivity reactions in the form of neurological disorders), is the starting-point for a popular series of anthelmintics. Piperazine salts themselves are markedly active against roundworms and pinworms, though inactive against microfilariae. Substitution of carbethoxy in the 1 position introduces filaricidal properties, and alkylation, particularly methylation, at position 4 intensifies the activity. Among the homologues with 1-substituents, the most useful clinically has been 1-diethylcarbamyl-4-methylpiperazine or diethylcarbamazine. This drug is effective against a variety of worms, and no better rela.ed d ug has yet been produced.

Compounds intended to kill external parasites and insect vectors of disease need a toxic group combined with a marked lipoid solubility so that the parasite will be able to absorb the drug on contact. Of the simple chlorinated hydrocarbons only p - dichlorobenzene and hexachlorocyclohexane (benzene hexachloride) are used for skin application, all others being too irritant. They are not unduly toxic if properly used, but their inhalation or ingestion renders them dangerous if care-

lessly handled. The gamma-isomer of hexachlorocyclohexane has a high potency; it is only one-twelfth as toxic as the beta- and one-quarter as toxic as the alpha-isomer.

Condensation of chlorobenzene with chloral yields dicophane, DDT or 1,1,1-trichloro-2,2-(bis-*p*-chlorophenyl) ethane, a compound which, despite its tendency to produce resistant insect strains, remains a very useful ectoparasiticide. Any modifications of the DDT structure result in a reduction of potency. It apparently acts by liberating free hydrochloric acid under biological conditions, and its marked lipoid solubility is an asset. It is noteworthy that resistance to DDT involves cross-resistance to sterically similar compounds though not to other chlorinated compounds of different shape.

Most development is concerned with adding potentiating agents to DDT itself. One such compound, *p,p'*-dichlorobenzhydrol, has negligible parasiticidal properties but possesses structural affinities with DDT. The dichloroethane compound corresponding to DDT, and the difluorodiphenyl compound also, are active insecticides. The fluoro-compound has a potential economic value, since it exerts powerful activity against malaria larvae but only feeble toxicity towards fish. Alkoxy compounds derived from DDT develop a knock-down power against insects which is lacking in the parent drug. Other analogues have interesting specificity against certain pests, but all lack the wide spectrum of DDT itself.

UK Plastics Production Up —But Sales Down says BoT

SALES of plastics materials in the second quarter of this year at 97,900 tons were nearly 2 per cent below those of the second quarter of 1957. The Board of Trade points out that the particularly fast growth in sales that occurred in the first three quarters of 1957 began to level off towards the end of the year, and although sales have now fallen below those of a year ago, they are still well above those of 1956.

Because of the stock build-up of plastics materials in the second quarter of this year, the estimated rate of production remained high and was about 4 per cent above that of a year earlier.

Sales of thermoplastic materials at 55,800 tons were about 1 per cent down, but there was a fairly large stock built up in the second quarter and production was maintained at about the same high rate as in the previous six months, and well above that of a year earlier. Stocks at the end of the second quarter of 1958 at 36,900 tons were 12,100 tons higher than a year earlier.

Of this stock increase, 10,400 tons was in 'other thermoplastic materials,' and stocks of polystyrene moulding and extrusion compounds increased in the year by 1,100 tons to nearly 5,000 tons. In polyvinyl chloride materials (other than resins) stocks of moulding and extrusion compounds increased in the year by 400 tons to 2,500 tons.

Exports of all plastics materials in the second quarter of 1958 were nearly 25,000 tons, regarded as a high level though lower than in recent quarters. Imports were 8,700 tons.

Performance of Rotary Concentric Cylinder Fractionating Columns

'STUDIES on the performance of rotary concentric cylinder fracionating columns' was the subject of a paper presented by Dr. N. Macleod and Mr. K. J. Matterson at a meeting of the Institution of Chemical Engineers, North-Western branch, held at Manchester on 14 October.

The fractionating column which was essentially a wetted wall column, consisted of two concentric cylinders, the inner one rotating, the outer one being stationary. Vapour from a still was passed through the annular space, was condensed at the top of the column and the liquid was returned to the column as a falling film down the stationary cylinder, which was lagged and heated to prevent loss of heat from the column. Such a column had a low HETP, a low pressure drop and a low hold-up.

The rotor operated in the vapour phase and mass transfer occurred across a stable, well defined vapour-liquid interface of the liquid reflux that fell down the stationary wall.

Dr. Macleod reported a further advance in the theory of operation of wetted wall columns, the effect of Taylor vortices which are produced by the rotating cylinder at speeds below those that produce general turbulence, and efficiencies of the column in the region of turbulences and vortices. A mixture of n-heptane and methyl cyclohexane of constant composition was used.

The major resistance to mass transfer for the above mixture was found to reside in the vapour phase. The increase in efficiency of the column caused by higher rotor speed was due to increased radial mixing of the vapour and not to any marked increase in mixing the liquid film. The onset of Taylor vortices produced an increase in efficiency of the column lower than was expected and this effect was attributed to back-mixing. No significant change in efficiency was obtained by further increases in rotor speed until the region of turbulent flow with vortices in the vapour phase was reached. Results in the turbulent region were related to theories of fluid mechanics.

Amber Chemicals Combustion Additives and Liquid Fuel Improvers

THE Amber Chemical Co. Ltd. (11a, Albemarle Street, London W1) announce that in the near future, their fuel additive Amber SSR 509, which was introduced to the market a year ago, will be wholly manufactured in this country. This will enable the company to ensure regular continuity of supply and quality.

Amber SSR 509 is stated to be characterised by its effectiveness in reducing sulphur corrosion. In many instances, this product is said to bring about an increase in the recorded percentage of CO_2 and a reduction in back-end temperature.

The addition of Amber SSR 509 to the fuel in the storage tank is effective in dissolving existing sludge and retarding further sludge formation.

Other benefits of Amber SSR 509 are: increased boiler availability; reduction in soot and carbon deposits; prevention of accumulation of corrosive deposits on economisers and air-heaters; efficient operation of boiler economisers when the boiler is on low load; and reduction in surface tension of the oil fuel, and better atomisation.

Increased selling and servicing facilities have been established by the company.

In addition to developing Amber SSR 509, Amber Chemical Co. have introduced to the market four new fuel additives and combustion improvers:

(a) Amber SSR 113—a powdered combustion improver for use in large industrial oil-fired installations, power stations, etc.
(b) Amber SSR 115—a powdered combustion improver for solid and pulverised-fuel installations.
(c) Amber SSR 511—a liquid fuel additive for residual fuel oils and C.T.F. (creosote pitch).
(d) Amber SSR 513—a liquid fuel additive for diesel oils.

BS for Acid-resisting Silicon Iron Pipes

REVISED British Standard for acid-resisting silicon iron pipes and pipe fittings (BS 1333/1958) deals with three types of pipes and pipe fittings: cone ended, spigot and socket, and plain ended. The size range is 1-12 in. nominal bore.

The main differences between this and the first (1946) edition are (a) there are now requirements for loose coupling flanges, and (b) requirements for the 2½ in. (64 mm.) and 5 in. (127 mm.) sizes have been omitted.

Because of their high corrosion resistance, these pipes are widely used in the chemical industry. Hence the importance of the standard's statement that 'the sockets of spigot and socket pipes will accept the plain spigots of chemical stoneware pipes of the same nominal bore'.

Copies are available from the BSI Sales Branch, 2 Park Street, London W1 (price 6s.).

Costs of Process Instrumentation Surveyed at I.Chem.E. Symyosium

CAPITAL cost of instruments and components, with the cost of installation and maintenance, was surveyed by Dr. D. W. Gillings, Imperial Chemical Industries central instrument laboratory, at a symposium on Chemical Engineering Economics held by the Graduates' and Students' Section of the Institution of Chemical Engineers on 23 and 24 October, in London.

The survey by Dr. Gillings included summaries of unit costs, maintenance costs, etc. Dr. Gillings gave examples of present trends such as the progressive change from pneumatic to electronic controllers and a widespread increase in use of direct analysis instruments, with the introduction of data logging and processing and ultimately on-line electronic computers as long-term developments. Also included was a brief analysis of problems in assessing economic return, which pointed out that process data were not always readily available for such assessment, but it should be possible in future for more data to be obtained from more comprehensive instrumentation and so these problems would be less formidable. In conclusion, it was pointed out that an economic analysis of the control system could not be complete if considered in isolation and such studies must be ancillary to good progress in technical innovation.

He showed that for a total of nine works where the value of instrumentation was £1,078,000 and the maintenance personnel numbered 116, the value of instrumentation maintained per man was £9,300.

Table I shows an analysis giving average instrument cost, percentage additions for accessories and installation and probable installed cost range.

Table II shows instrumentation costs for typical plants.

TABLE I

Type of Unit	Base Cost	Add percentages for Accessories	Add percentages for Installation	Probable Installed Cost Range
	£	£	£	£
Differential flow indicator	100	65	15	160–200
Differential flow recorder	105	70	25	180–220
Pressure recorder	45	30	20	over 80
Temperature recorder (bulb)	70	30	18	110–130
Potentiometric recorder (1 record)	180–250	15	10	230–300
Potentiometric recorder (6 record)	300–500	45	20	450–750
Pneumatic control (components and accessories) ...	110	—	45	150 upwards
Pneumatic transmission (components and accessories)	85	—	25	100 upwards
Control valve (per 1 in. of dia.)	60	50	30	100 upwards

TABLE II

Type of Process	Capital Cost (£) Plant (1)	Capital Cost (£) Instruments (installed) (2)	Instrument Cost as % of Plant Cost Purchase and Installation Cost (3)	Instrument Cost as % of Plant Cost Purchase & Installation & Design Cost (4)
Continuous Multi-Stage	11,000,000	650,000	6	7.5
	4,200,000	250,000	6	7.5
Small Continuous	920,000	71,000	7.6	9.0
	160,000	11,000	7.0	8.5
	120,000	12,000	10.0	12.0
Large Batch Multi-Stage	7,500,000	330,000	6.6	8.0
Batch and Batch/Continuous	750,000	75,000	10.0	12.0
	480,000	23,000	4.8	6.0
	190,000	16,000	8.5	10.0

Liquid Amalgams as Reagents

(*Continued from page* 720)

cally at least, has a much wider range of application than zinc amalgam. Reaction with the solvent is, however, a major problem with such a reactive amalgam and although ether gave suitable blanks, it is undesirable as a solvent because it is aprotic in nature. Reductions with barium amalgam in absolute ethanol yielded non-stoicheiometric results. There is little doubt that a careful search should reveal a suitable solvent medium for use with such reactive amalgams.

In conclusion it may be said that the method has many possibilities—one being the determination of dissolved oxygen in water—and there is little doubt that the authors have presented analysts with a most versatile and valuable tool for the analysis of a very wide range of compounds, both inorganic and organic.

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'A Ministry of Science'

President of the Federation of British Industries, Sir Hugh Beaver, will address the second annual meeting of Scientific Societies in South Wales and Monmouthshire on Friday, 21 November, in the National Museum of Wales at 7.30 p.m. His subject will be 'A Ministry of Science.'

ICI Not to be Nationalised says MP

MR. P. MAYNE, technical director, Billingham Division of Imperial Chemical Industries Ltd., presenting long-service awards to the firm's employees recently, said that ICI was a living thing and its life stream consisted of inventions, ideas, loyalties and team spirit. There was only one thing which could make the firm cold and dead before its time, and that was the strangling hand of nationalisation. ICI served a lot of other companies and followed the trade of the country.

Mr. George Chetwynd, Labour M.P. for Stockton-on-Tees, stated later that the nationalisation of ICI would not figure in his party's programme at the next General Election. He said, however, there might be an inquiry 'into the general working of the chemical industry'.

TI Draw Longest-ever Small Bore Be Tube

RESEARCH in the fabrication of beryllium carried out by Tube Investments Ltd., Adelphi House, John Adam Street, London WC2, has resulted in the drawing of what is believed to be the longest small-bore beryllium metal tube yet produced. The bore of this tube is 0.30 inch, wall thickness 0.04 inch and the tube is between two and three feet long. A beryllium tube of similar length with a diameter of 0.70 inch and a wall thickness of 0.012 inch has also been produced as well as other tubes having wall thickness of 0.08 inch upwards and diameters of 0.5 inch upwards, and between eight foot and 10 foot long.

Kenya Pyrethrum Officials in London

Increased sales of African pyrethrum are expected as a result of a tour of the US and the UK just completed by two representatives of this industry. The representatives are: Mr. R. T. Mytton Watson, deputy chairman of the semi-official Pyrethrum Board of Kenya, and Mr. N. H. Hardy, executive officer of the Board.

Determination of Oxygen and Hydrogen in Steel

Carrier-gas techniques for oxygen and hydrogen determinations in steel were described by C. E. A. Shanahan at a joint meeting of the SAC and Sheffield Metallurgical Association on 21 October. Oxygen was determined by high-temperature reaction between the steel sample and graphite and the CO evolved was oxidised to CO_2 which was absorbed and weighed. Precision and speed of the method were dependent on carrier-gas flow rate.

Hydrogen was determined by a low-temperature carrier-gas extraction procedure whereby hydrogen was evolved which after oxidation to water was absorbed in methanol and titrated with Karl Fischer reagent using a dead stop endpoint.

L. to r. at Lederle, Gosport, H. J. Podmore, Birlec, Mrs. Jackson, Lederle, J. B. Haggis, Pye Industrial Electronics, R. Burges, Birlec, J. D. N. Sharrock, Parke-Davis, L. W. Batchelor, Birlec, J. A. Milton, Meredith and Drew, P. S. V. Oakes, Courtaulds, L. S. Dormer, Distillers, J. B. Ritchie, Bakelite, D. Hackett, Birlec, R. A. Pearse, UK AEA, D. Lee, Abbott Laboratories, R. G. Bristow, Distillers, E. P. Coote, Standard Telephones, P. B. Read, Atomic Weapons Research Establishment, L. H. Bellamy, Lederle, G. B. Lechmere, AEA, J. H. Crossley, Birlec, N. Whittaker, Air Ministry, C. T. Cresswell, Lederle, A. F. Archer, Birlec, W. L. Cotterrell, Cadbury, D. M. Pratt, AWRE, J. Steventon, AWRE, C. G. Hewett, Fairey Aviation, D. H. Edwards, AWRE, E. A. Burfoot, Riker Laboratories, J. D. Winter-Goodwin, English Electric, T. C. Sanders, Birlec, W. McLellan, Glaxo, A. G. Horton, Ilford, F. A. Soward, E. N. Mason, M. O. F. Tapper, Upjohns, W. C. Dowlen, A. and H.

Chemical Managers See Birlec Air-Conditioning Plant

THE Birlec air-conditioning plant installed at the Lederle Laboratories of Cyanamid of Great Britain Ltd., Gosport, for the production of antibiotics was inspected recently by a group of production managers, works engineers and works managers from the chemical and allied industries. First they lunched at the Dolphin Hotel, Southampton, as guests of Birlec Ltd., Tyburn Road, Erdington, Birmingham 24.

Lederle chose Birlec direct dehumidification adsorption drying equipment of the continuous, self-regenerating type, which requires little supervision and the minimum of maintenance. These direct dehumidifiers utilise activated alumina as the adsorbent material. The air to be dried is presented to this desiccant as it lies in shallow beds on perforated trays. A system of rotary valves, motor-driven under electric timer control, ensure that each alumina bed in turn performs its adsorbing duty and is then dried (reactivated), cooled and so made ready for its next period of drying.

The adsorption and reactivation airstreams are moved by a Duplex fan set, having a fan on each end of the shaft of a double-ended motor. The fan moving the adsorption air delivers this at positive pressure to the drying beds and thence through an after-cooler to remove the heat picked up in the process and on to the ducting connecting the dehumidifier to the air-conditioning system.

Air required for reactivation of the moisture-laden alumina in beds which have just completed a period of adsorption duty is first drawn through a heater before passing over the beds. The adsorbed moisture is thus carried off from the beds and exhausted to atmosphere through the reactivation fans and suitable ducting.

Heating the reactivation air stream can be done by means of electric, gas or steam heaters; in the case of the Lederle installation the availability of steam at 100 p.s.i.g. indicated this as the most suitable source of heat.

At the Lederle plant, four main areas are each conditioned to relative humidities ranging from 10 to 50 per cent at dry bulb temperatures of from 65 to 80°F, according to the needs of each area. Control of the degree of dehumidification in each main area is by means of a PAM humidistat mounted in the main return from the area to the associated recirculation fan.

Only in the sterile area is the whole of the air flow passed through the dehumidifier. To ensure that sterile air only is delivered, filters of ACI Ltd. manufacture are provided for the whole of the recirculated air flow.

In the encapsulation department, the air returning to the dehumidifier unit passes through fibreglass filters to prevent dust contamination of the alumina beds, with consequent reduction of adsorptive efficiency.

Birlec direct dehumidifiers are also used by Aspro (tabletting and packing areas); Courtaulds (process air); ICI Pharmaceuticals Division (packing penicillin); Pfizer (antibiotic production); Reckitt and Coleman (tabletting and packing); Siemens Edison Swan (transistor production); UK AEA, Dounreay (reactor sphere conditioning); Whiffen (drying out blowing agents).

Record Year for Fertilisers, says Billingham Division Chairman

ON the note that in spite of the checks encountered in some parts of their business the company was strong and vigorous, Mr. W. J. V. Ward, chairman of the Billingham Division of ICI wound up his speech to the Divisional Council. Recent figures showed an increase in 1958 over 1957, of 228 in the number of tradesmen employed, of 286 in general workers and of 400 in work study.

Commenting on the effect of the weather this summer on the harvest, he said its effect on the fertiliser trade had yet to be seen. The amounts of fertiliser used in UK during 1957-58 were greater than in the previous year and were a record.

The new CCF plant at Billingham had started successfully and, with the extensions of the 'Nitro-chalk' plant at Heysham, showed that the division had made preparations to meet any increased demand that might arise. Despite strong competition abroad in the sale of fertilisers, large amounts of ammonium sulphate were still being exported from Billingham and Prudhoe.

Mr. Ward also commented on the continuing great demand for liquid CO_2 by AEA and on the increasing sales of liquid argon needed by one customer in the manufacture of transistors. Referring to new uses for old products, he said that a special grade of ammonium nitrate was now being mixed with diesel oil for use as a blasting explosive.

Sales of NH_3, H_2SO_4 and urea were similar to 1957 and home trade might be increased by easing of credit restrictions but there was greatly increased competition in export markets from some producers who were willing to quote very low prices.

About research, he mentioned the completion of a new research block now in operation which had relieved pressure on laboratory space. The research department had solved the problems which had arisen from the use of urea in fertilisers instead of ammonium sulphate, and a special grade of urea was now available for this purpose.

Will

MR. HENRY ELLISON, founder chairman of the Yorkshire Tar Distillers Ltd., and founder of the Killgerm Co. Ltd., Cleckheaton, and the Mirvale Chemical Co. (in 1943 he gave £50,000 to Leeds University to create an endowment fund), died on 15 July last, aged 86 years, leaving £565,512 6s 3d gross, £543,378 11s 9d net (duty paid £440,915).

Overseas News

MONTECATINI'S LARGE-SCALE EXPANSION SCHEME IN PLASTICS AND PETROCHEMICALS

AT an extraordinary general meeting held in Milan last week some 500 shareholders of the Italian Montecatini chemical concern approved the raising of a 20-year 6 per cent loan of 30,000 million lira (about £16.7 million) (see CHEMICAL AGE, 4 October, p. 570). The loan will make possible large-scale expansions in the Montecatini production programme, particularly in the plastics and petrochemical fields.

These expansions of production will comprise, among others: extension of existing polypropylene plants and the erection of new ones; the building in Southern Italy of a petrochemical plant for the production of modified types of polypropylene and various plastics from this based on ethylene; and the erection at the Terni plastics plant of the Polymer Group (a group of companies) of a plant for the production of a totally new synthetic fibre. This last is said to be produced via a cracking process from a propylene base and was 'extraordinarily elastic and strong'; its specific weight—0.91—was the lowest yet in synthetic fibres. Some 5,000 metric tons of this would be produced annually in the first instance.

Other synthetic fibres were also 'on the way' from Montecatini, said a spokesman.

East German Nünchritz to Produce Caustic Soda

The East German chemical concern VEB Chemiewerk Nünchritz has announced large-scale extensions. The main project is the building of a 22,000-amp. electrolysis installation for the production of caustic soda. This plant will be completed by 1961 and caustic soda output in 1962 will be an estimated 25,000 metric tons.

Silicon, of which Chemiewerk Nünchritz are the sole East German producers, will also be produced in larger quantities. Extension of the existing plant will take place in two stages, phased to end in 1965, the first of these will increase present capacity by fivefold and the second by tenfold. No figures are available of present silicon capacity.

Dow Introduce Two New De-icing Chemicals

Two new de-icing products, Dow Deicing Fluid 20 and Dow Deicing Fluid 10, are being marketed by Dow Chemical International Ltd.

Dow Deicing Fluid 20 is primarily an ethylene glycol-propylene glycol formulation. Its main advantage is stated to be its ability to de-ice at greater dilution. This increase in effectiveness is due to its lower freezing and slush points. A wetting agent permits No. 20 to be distributed evenly over an aircraft surface and to perform satisfactorily even where oil and gasoline have formed films over parts of the plane. It can be used as a hot spray solution. Flash point is 123° Celsius and the product is specifically formulated to be used at temperatures as low as −46° Celsius.

Dow Deicer Fluid No. 10 has lower slush and freezing points than those fluids containing no alcohol, which makes possible successful de-icing at greater dilution. When diluted with equal parts of water, it is claimed that it can be used at temperatures as low as −59° Celsius. It also effectively penetrates oil and gasoline film. With use of No. 10 ice is stated to melt somewhat faster than Fluid 20. It has a flash point of 32° Celsius.

Both fluids contain corrosion inhibitors to protect metal surfaces and parts. Neither product, Dow state, crazes plastic nor adversely affects paint and rubber.

Hungary Builds a Chemical Institute For Atomic Research

Work has begun in Budapest on the building of a central chemical research institute where the peaceful uses of atomic energy will be studied and existing institutes gathered together under one roof. Professor Géza Schay, director of the new institute and a Kossuth prize winner, has stated that the nuclear chemistry department of the institute is already investigating the make-up of tracer organic compounds and is making use of radioactive isotopes sent from the Soviet Union. It will also use its own isotopes when a new experimental atomic reactor is completed. The institute is trying to evolve a method for the direct utilisation of radioactive isotopes in medicine and engineering and is examining the effects of radiation on various chemical processes.

Degussa Atomic Energy Projects

Degussa AG have issued details of atomic energy projects in which they have been concerned in recent months. These include experiments begun at Degussa's Wolfgang plant into the development of uranium isotope separation processes, particularly in connection with the production of heavy water, and the drawing-up of a plan with AB Atomenergi, the Swedish atomic undertaking, to exchange processes. Atomenergi have in the past few weeks decided to set up a heavy water processing plant at their main installation in Sweden.

Other Degussa projects include: the setting-up of an experimental plant in India, which will produce 20 metric tons of pure nuclear uranium a year by a new fluoridisation process, and the supply of uranium-processing plant to the Indian atomic energy board; the supply of two high-vacuum uranium melting plants to Italy, and a special furnace to Sweden (not to Atomenergi) for the sintering of uranium oxide cylinders; the supply to Argentina of pure uranium-producing plant, for an experimental installation with an initial production of 10 metric tons annually, by an ammonium difluoride process for uranium ore concentrates. This plant will later be extended.

Teflon Coatings for Heat-sensitive Materials

Dispersions of Teflon tetrafluoroethylene (TFE, produced by E. I. du Pont de Nemours Co., US) resin in various resin binders enable Teflon coatings to be put on materials that are too heat-sensitive to withstand the sintering temperature for Teflon particles (700°F).

The new products, which are stated to be codispersions—a dispersion of TFE particles in a liquid carrier, mixed with a resin dispersion—have been developed by Acheson Colloids, US. They are commercially available as Emralon 310 and 320. Emralon 310 is a dispersion of TFE in a phenolic binder. It is applied by an external-atomising type spray gun, using air pressures of 35 to 50 p.s.i. and the coating is cured by heating for one hour at 300°F by infra-red or oven. The coating is described as a suspension of Teflon particles (about 0.2μ in diameter) in a resin film. Emralon 320 has a lacquer-type binder, and produces an air-drying film, so that it can be applied to very heat-sensitive materials or where baking is impractical.

Applications of Emralon are stated to be in industrial machinery, where the Teflon coating can reduce the collection of dirt, excessive grease and corrosive substances, and for coating moulds, drums, extrusion dies, gaskets, bearings and conveyors.

US Rocket Fuel Plant for South Australia ?

US interests are reported to be considering the setting up of a £A15 million enterprise in South Australia to make fuel for rockets and jet aircraft. It is proposed to obtain this fuel from untapped borax deposits in the salt lake wastes of the State. The fuel is a mixture of hydrogen and boron. The US company stated to be interested in the project is Dow Chemical Corporation.

Sulphuric Acid Plant Extension In Belgian Congo

Two roasting furnaces capable of producing 132,000 tons of sulphuric acid per year complete the extension of the plant of the Societe Generale Industrielle et Chimique in Belgian Congo.

PEOPLE in the news

● For the third year in succession the Nobel Prize for chemistry has been awarded to a British chemist. The 1958 prize has been awarded to DR. FREDERICK SANGER, B.A., PH.D., F.R.S., who has been a member of the biochemistry research staff at Cambridge since 1939, for his work on the structure of insulin. He has been on the staff of the Medical Research Council since 1951. Dr. Sanger held the Biet Memorial Fellowship for medical research from 1944 to 1951 and was awarded the Corday Morgan Medal and prize of the Chemical Society in 1951. He is a fellow of Kings College, Cambridge.

● MR. G. C. R. ELEY has joined the board of British Oxygen. Mr. Eley is chairman of British Drug Houses and a director of Thomas Tilling Ltd. and James A. Jobling.

● Managing director of the new Evans Medical subsidiary company, Evans Medical (Midlands) Ltd., is MR. GRAHAM A. UHLSON, who until recently was managing director of Evans Medical (Wales).

● MR. J. A. GAY has been appointed patents exploitation officer to the UK Atomic Energy Authority in succession to MR. T. BENSON GYLES.

● DR. D. T. A. TOWNEND, C.B.E., director general of the British Coal Utilisation Research Association and past president, Institute of Fuel, was the first UK recipient of the gold medal of the Institut Francais des Combustibles et de l'Energie, at a ceremony held in Paris on 21 October. The medal is designed to recognise outstanding scientific achievement in the field of utilisation of fuel and power.

● MR. MICHAEL RICHARDS has been appointed a director of British Benzol and Coal Distillation.

● MR. W. A. DUTTON, assistant director, Hosiery and Allied Trades Research Association, and MR. H. MARSDEN, M.C., M.Sc., Universal Winding Co. Ltd., Manchester, have been awarded the Institute Medal of the Textile Institute.

● DR. P. B. AYSCOUGH, M.A., PH.D., has been appointed lecturer in the department of physical chemistry, Leeds University. DR. A. J. KENNY, M.B., B.S., PH.D., has been appointed lecturer in biochemistry.

● MR. GEORGE F. A. BURGESS has been appointed a director of the Esperanza Copper and Sulphur Co.

● Winston Electronics Ltd. Shepperton, Middx, have appointed four specialist regional technical sales engineers. MR. K. P. REYNOLDS, based in Manchester, will cover Yorks, Lancs, Ches, and the north; MR. P. REEVES, from Birmingham, will be responsible for Derbys, Notts, Lincs, Staffs, Salop, Worcs, Northants, Leicestershire and Rutland; MR. V. DIEDERICHS will cover London south of the Thames, Glos, Oxon, Wilts, Berks, Hants, Dorset, Sussex, Kent and Surrey; MR. D. A. JAMIESON will cover London north of the Thames, Cambs, Herts, Bucks, Beds, and Middlesex.

● MR. J. MOFFATT of BP has been appointed deputy general manager (refineries) while DR. T. TAIT becomes manager (refineries division).

● MR. C. L. MORE has been appointed chief chemist of Acheson Dispersed Pigments Co. MR. K. CLARK has joined the same company as head of sales and technical service in the South of England.

● MR. R. B. CRAIG, resident director at the Luton works of Laporte Chemicals Ltd., retired on 30 October after 36 years' service.

● Following the resignation of SIR GEORGE WALTON, MR. KENNETH W. STREITH will assume the office of chairman of the administrative committee of Thomas Hedley and Co.

● MR. H. J. TALBOT, managing director of the Dorr-Oliver Co., has been appointed to the board of Dorr-Oliver Incorporated of the US.

● MR. H. S. HENDERSON, who was for 30 years with Cyanimid Products and came out of retirement in December 1956 to become managing director of Chemical Construction (Great Britain) has now retired from the board of that company.

● DR. H. M. FINNISTON has been released by UK AEA to take up his appointment as research manager of C. A. Parsons and Co.'s nuclear research centre.

● MR. PETER CLARK, B.Sc., A.R.S.M., has joined Metal and Pipeline Endurance Ltd. (MAPEL), Artillery Mansions, Victoria Street, London SW1, as a senior corrosion engineer. Mr. Clark has for the past eight years had experience with the British Petroleum Co. on corrosion engineering in Persia, Kuwait and Aden.

● MR. CHARLES A. WRIGHT is the new president of Freeport Sulphur Co., New York. He was former head of the London office of the Bankers Trust Co.

● MR. JACK CARR is resigning his present appointment, as sales manager, with Davey and Moore Ltd., to go into partnership with Dr. H. Ellis in Pyrometric Equipment Co. Ltd. (see p. 730).

CSIR Plans For UK Timber Research

ALL timber research will ultimately be cencentrated at Princes Risborough, the site of the present Forest Products Research Laboratory, states the Council for Scientific and Industrial Research. Discussions are being held to determine the type of organisation which would most effectively co-ordinate the research needs of the Timber Development Association and the Forestry Commission.

The Council has set up with immediate effect a steering committee to look after the research programme of the FPRL, in place of the forest products research board. The committee comprises: Chairman, Dr. B. K. Blount, C.B., deputy secretary, DSIR; H. Douglass, general secretary, Iron and Steel Trades Confederation; L. J. Cardew Wood, managing director, Bell's Asbestos and Engineering Ltd.; Dr. F. Y. Henderson, director, FPRL; and H. Wooldridge, head of Stations Division at DSIR headquarters.

Torry Research Station

The Council for Scientific and Industrial Research announces that responsibility for the research programme of the Torry Research Station at Aberdeen which is concerned with the presentation, storage and distribution of fish, will be vested in a steering committee consisting of chairman: Dr. B. K. Blount, deputy secretary DSIR; members: G. C. Wilson, member White Fish Authority and Herring Board; Dr. D. Traill, director of research, Nobel Division, Imperial Chemical Industries Ltd.; Dr. G. A. Reay, director of the Torry Research Station; and H. Wooldridge, Station's Division, DSIR headquarters.

Will

SIR GEORGE EVETTS, chairman of Colombo Gas and Water Co., and a director of British Benzol and Coal Distillation, left net estate £28,034.

Obituary

MR. T. W. PRICE, co-founder, chairman and former managing director of A. S. Price and Co. Ltd., manufacturing chemists, of Blackheath, Birmingham, has died aged 74.

TRADE NOTES

Foam Plastics

Delcon Sponges Ltd., apart from carrying a stock of foam plastics of varying specifications, also specialise in fabricating any shapes which may be required for technical, packaging or other purposes.

New South African Agents

The appointment of ICI (South Africa) Ltd. as agents for Price's (Bromborough) Ltd. is announced. ICI will represent Price's for the sale of oleochemicals in South, East and West Africa from 1 November.

Telex System Installed

Griffin and George Ltd., laboratory suppliers, are now connected to the Telex system at their Alperton warehouse (Telex 21126) and Birmingham warehouse and works (Telex 33303).

UK Equipment for Poland

Following the contract secured by Petrocarbon Developments last year for the engineering of a plant in Poland for the production of polystyrene, orders for equipment for the plant are now being placed in the UK. Value of the orders is placed at approximately £140,000.

Chemical Contractor's Office

Charlton, Weddle and Co. Ltd., industrial, chemical and marine pipe work contractors, of Manor Works, Newcastle, have opened a London office at 34 Crutched Friars, London EC3: telephone ROYal 1576. In charge of the new office is Mr. Gavin Thomson.

Geigy's New Pigments

Now freely available are Irgalite Yellow SPV8 and Irgalite Red SPV3, two recent additions to Geigy's range of pigments for emulsion paints.

Diabinese from Pfizer Ltd.

Diabinese, the new oral hypoglycaemic agent recently introduced by Chas. Pfizer and Co., US (see CHEMICAL AGE, 18 October, p. 649) is now available from Pfizer Ltd., Folkestone, Kent.

Beneficiated Hectorite

In a note on the availability of beneficiated hectorite (Mecaloid) through UK agents, Production Chemicals (Rochdale) Ltd., 32 Deansgate, Manchester, 3 (CHEMICAL AGE, 11 October, p. 606) the product was referred to as Lectorite. Mecaloid is beneficiated magnesium-lithium bentonite. US principals of the UK agents are the Inerto Co., San Francisco.

BDH Catalogue Additions

New entries in the BDH catalogue include bornyl chloride, 1:3-dioxolane, sodium salt of isethionic acid, crystalline papain, potassium diuranate, sodium diuranate and the Union Carbide molecular sieve type 13X.

The sieve now available is a crystalline sodium alumino-silicate with an effective pore diameter of about 10Å. Molecules absorbed by type 13X include acetylene, ammonia, benzene, *iso*-butane, carbon dioxide, *n*-heptane, *n*-hexane, hydrogen sulphide, methanol, nitrogen, propane, propylene, water and *m*-xylene.

Industrial interest in sodium isethionate lies mainly in its use in the manufacture of detergents. For details see US Patent No. 2,535,677 (*Chem. Abstr.*, 1951, **45**, 3408).

Sodium Chlorate Drawback

Rate of drawback allowable in respect of Customs Duty paid on certain sodium chlorate used in the manufacture of specified descriptions of compound weedkiller has been increased from £5 10s to £6 10s per ton. This drawback scheme has been extended to certain types of exported weedkiller and imported sodium chlorate not previously covered.

Graphite Block Heat Exchangers

An additional model having a heat exchange area of 300 sq. ft. has been added by Powell Duffryn Carbon Products Ltd. to the long tube type of graphite heat exchangers.

Change of Name

As from 8 October, the name of Foulds and Jackson Research Laboratories Ltd., Sidcup, Kent, has been changed to Foulds Research Laboratories Ltd.

Changes of Address

The Electrofact instrumentation division of Hartley Electromotives Ltd. is now at Automation, Systems and Control Ltd., 88 High Road, Bushey, Herts.

Du Pont Co. (United Kingdom) Ltd., 5 Charles II Street, London SW1, have changed their address to 76 Jermyn Street, London SW1, telephone number TRAfalgar 1571 (10 lines). All communications other than those to their London engineering office should be sent to this new address.

National Benzole and Allied Products Association have moved to new premises. Their new address is Granville House, 132-135 Sloane Street, London SW1, telephone number SLOane 0023/7.

Price Cut for Scopolux

Styrene Co-Polymers Ltd. have considerably reduced the prices of their Scopolux 151 series. Full details are available from head office, 1 Roebuck Lane, Sale, Cheshire.

Precipitated Calcium Carbonate

A new leaflet describing the characteristics of some of their grades of precipated calcium carbonate has been published by John and E. Sturge Ltd., Wheeleys Road, Birmingham 15.

The grades dealt with include uncoated ultrafine Calofort U, and the equivalent activated grades, Calofort S and T, in which the surface of each particle is coated with 3 per cent and 1½ per cent stearate respectively. All three are used mainly as extenders in printing inks and in the manufacture of paint, but the activated grades are also useful fillers for p.v.c. and, in the rubber industry, as white reinforcing fillers. Two other activated grades, Calopake FS and Sturcal LS—both of which have 1 per cent stearate coatings—are also described briefly.

Product Group Within FBRAM

Within the Federation of British Rubber and Allied Manufacturers a new product group has been formed with the objects of collecting statistics of work done in industrial installations and of exchanging and co-ordinating technical information. The group covers plant linings in rubber and ebonite.

Study of Flow of Granules Through Apertures

A corrected version of the paper 'Exploratory study of the flow of granules through apertures' (CHEMICAL AGE, 25 October, p. 685) has now been submitted. Corrections are as follows: Paragraph 5 line 8, $\Psi = \rho/QA\ (gP)^{-\frac{1}{2}}$ to read $\Psi = Q/\rho A(gP)^{\frac{1}{2}}$: line 9, $\Psi = \beta\ (H/K)\exp\ (-\gamma K/H)$ to read $\Psi = \beta(H/K)^{\frac{1}{2}} \exp\ (-\gamma K/H)$; line 15 ϕ = mass flow rate to read Q = mass flow rate; line 16, cm. $-s^2$ to read $cm.s^{-2}$; paragraph 6, line 3, $\Phi = f\ (H/K, H/T)$ to read f (H/K, H/T) where f = function; paragraph 8, line 1, 'velocity Ψ is stated' to read 'velocity ϕ [$\phi = Q/\rho A(gH)^{\frac{1}{2}}$] is stated'; paragraph 9, line 3, $Q = 2.72A(H)^{\frac{1}{2}}\Psi$ to read $Q = 2.72A(H)^{\frac{1}{2}}\phi$; line 4 $Q = 2.24D^{2.5}\ \Psi$ to read $Q = 2.24D^{2.5}\phi$.

DIARY DATES

MONDAY 3 NOVEMBER

SCI, Yorkshire section with **Bradford CS**—Bradford: Technical College, Great Horton Road, 7 p.m. 'Combustion of sulphur under high pressures', by D. J. Cowling. 'Fractionation of Terylene', by R. P. Sheldon. 'Observations on the paper chromatography of sulphonephthalein indicators', by F. Beaumont and P. B. Cook.

SCI with **Brit. Weed Control Council**—Brighton: Metropole Hotel. Fourth British Weed Control Conference. Until 6 November.

WEDNESDAY 5 NOVEMBER

SAC—London: Burlington House, W1, 7 p.m. 'Volumetric analysis of stannous and total tin in acid-soluble tin compounds', by J. D. Donaldson and W. Moser. 'Modification to the Unicam SP500 spectrophotometer for single-beam recording', by D. D. Shrewsbury.

Incorporated Plant Engineers—Leicester branch: Bell Hotel, 7 p.m. 'Thermoplastics with special reference to use of nylon in industry', by C. C. Morgan.

THURSDAY 6 NOVEMBER

SCI with **Birmingham Paint Varnish and Lacquer Club**—Imperial Hotel, Temple Street, 7-45 p.m. 'Recent advances in drying oil chemistry', by Prof. T. P. Hilditch.

CS—London: Burlington House, W1, 7-30 p.m. Irving Langmuir Memorial Lecture, by Sir Eric Rideal.

SAC—Manchester: University, Oxford Road, 7-15 p.m. 'Chemical examination of textiles', by J. M. Bather.

Inst Metals—London: Royal School of Mines, SW7, 7 p.m. 'Experimental features of investigations with radioactive materials', by Prof. J. G. Ball.

Inst Metals and **E Midlands Metallurgical Soc**—Derby: College of Art, Green Lane, 7-30 p.m. 'Titanium—a broad survey', by Maj. P. Litherland Teed.

FRIDAY 7 NOVEMBER

SCI, Newcastle with **RIC**—Stockton on Tees: William Newton School, Norton, 8 p.m. 'Acetylinic approach to the synthesis of natural fibres', by Prof. R. A. Raphael.

CS and **Cambridge University CS**—Cambridge: University Chemical Laboratory, Lensfield Road, 8 p.m. 'Some reactions of nitrous acid', by Sir Christopher Ingold.

Commercial News

- **Financing Associated Chemical New Projects**
- **Courtaulds' Maintain Interim at 3%**
- **Dunlop's Half-year Group Sales Up £6 m.**
- **Fisons' Net Profit Up at £1.59 m.**

Aspro-Nicholas

If the proposed sales of their holdings in Clinical Products to Aspro-Nicholas is approved, the board of Clinical and General Industries at present intend to retain the Aspro-Nicholas shares to be received as a long-term holding, and to continue the company as an investment and property holding concern.

Clinical Products' Richmond premises have been acquired, and until the transfer of manufacturing activities to Aspro-Nicholas factories is completed, the latter will pay a reasonable rental for their use. Negotiations are in hand in respect of various propositions for the remunerative employment of resources.

Mr. Rety, chairman of Clinical and General, has informed shareholders that, subject to the present deal becoming unconditional, it is proposed to declare a 5 per cent interim (7½ per cent dividend forecast for the year to 31 March 1959). Barring unforeseen circumstances, the board intend to pay a similar final.

Associated Chemical

Particulars have been made available of an issue by Associated Chemical Companies of £1½ million 6 per cent debenture stock 1973-83. Interest on the stock is covered over nine times by the group's three-year profit average.

Net proceeds, estimated at £1,474,000, will be used for further development and modernisation schemes relating to the group's existing products.

Trading for the first eight months of the current year are reported as being approximately the same, and the directors expect 1958 profits will be about last year's level. Despite conditions at home and overseas becoming increasingly competitive, companies in the group are stated to be beginning to receive some of the benefits of the capital expenditure of recent years.

British Alkaloids

British Alkaloids are maintaining their interim dividend at 10 per cent in respect of the year to 31 March, 1959. A final of 20 per cent made a total of 30 per cent for 1957-58.

Sales for the half year to 30 September are reported as showing appreciable expansion in relation to those for the same six months of 1957.

Courtaulds Ltd.

In the light of current earnings and of the outlook for the remainder of the financial year ending 31 March 1959, Courtaulds are maintaining the interim dividend at 3 per cent. The total dividend for 1957-58 was brought up to 8 per cent with a five per cent final.

During the first half of the current financial year trading profits of the company are reported as having been less than those for the corresponding period of the preceding year. There are, however, in certain directions signs of the improvement for which hopes were expressed by the chairman, Sir John Hanbury-Williams, at the meeting last July. Should this improvement be maintained the net profits of Courtaulds for the full year available for distribution, after taking into account changes in the basis of profits tax, are expected to be close to those for the last financial year.

It is expected that British Celanese will resume the payment of an ordinary dividend in respect of the current financial year. (The last payment by British Celanese was 4½ per cent for 1956-57). Current profits of British Nylon Spinners are reported as being at a materially lower rate than in the previous year, but the board says it has no present reason to expect a reduction in the dividend receivable from that company. British Cellophane are maintaining their level of profits.

Overseas interests of the group have so far shown no great change on the results for the corresponding period of last year.

Dunlop Rubber Co.

Total group sales of the Dunlop Rubber Co., for the first half of this year at £120 million, were £6 million higher than in the corresponding period last year. Untaxed group profits were £0.2 million down, however, at £5.53 million and £1.22 million less than in the second half of 1957. The group net balance from trading for the first six months of this year, is stated to compare favourably with the results for the corresponding period of 1957.

Trading results so far for the second half of the year are reported as being maintained at a level similar to that of the first six months. It is not expected that untaxed group profit for this period will reach the record level achieved during July-December, 1957, due to the more difficult trading conditions.

The interim dividend is being raised from 3.6d to 5d per 10s unit or from 3 per cent to 4 1/6 per cent on account of 1958. Total distribution for 1957 was 14 per cent.

Fisons Ltd.

Group trading profit and investment income of Fisons Ltd., increased from £3,094,891 to £3,142,478 in the year to 30 June 1958. These figures were struck after depreciation of £1,184,609 against £1,013,086 and interest charges of £437,497, compared with £257,091.

After a low tax charge of £1,541,153 (£1,567,418) and minority interests of £6,355 (£11,060), group net profit is up from £1,516,413 to £1,594,970.

The final dividend at 10 per cent is as forecast and is on the £7,739,816 ordinary capital, making, with the 5 per cent interim on the capital prior to a one-for-three 'rights' issue, an unchanged total of 15 per cent.

Pyrometric Equipment Co.

Pyrometric Equipment Co. Ltd., Market Harborough, Leics, now incorporated into a limited liability co., has taken over the assets of Dr. H. Elliss, who founded the company some nine or ten years ago. From a metallurgical consultant's business it became a general laboratory supply house, specialising in furnaces, and thermocouples which they manufacture themselves. They are also agents or stockists for manufacturers of laboratory supplies—scientific glassware, porcelain, quartz, filter papers, etc. Directors of the new company are Dr. H. Elliss and J. D. M. Carr.

Vokes Ltd.

A final dividend of 12½ per cent plus a bonus of 5 per cent is declared on ordinary shares by Vokes Ltd., as increased by the issue of 300,000 shares of 4s against the acquisition of Robert Kellie and Son. This makes, with the 7½ per cent interim on the former capital, an unchanged total of 25 per cent for the year to 30 June 1958.

Group trading profit has increased from £414,530 to £456,836. After tax of £307,237, against £249,228, the net profit is down from £165,302 to £149,599.

St. Gobain

The French chemical and glass manufacturing concern St. Gobain has announced that in the second half of this month it will arrange for the fixing of a loan in Switzerland of 50 million S. Frs. (about £4,170,000). At present this is expected to be repayable at a rate of 4½ per cent.

NEW COMPANIES

PHOSPHATE PROTECTION LTD. Cap. £100. To carry on the business of civil, mechanical, electrical and general engineers, etc. Directors are J. Nowthorpe, Landhurst Wood, Upper Hartfield, Sussex; R. A. Parsons, Stone Court, Worth, Sussex; S. A. C. Burton and J. H. Keely. Secretary: L. L. Tutill. Reg. office: Gatwick Road, Crawley, Sussex.

TEXTOLUBE LTD. Cap. £100. Manufacturers, producers, distillers, and dealers in oils for industrial use in the textile trade, etc. Reg. office: Station Oil Works, Gomersal, Yorks.

Market Reports

FAIR AMOUNT OF NEW ENQUIRY

LONDON There has again been little of outstanding interest to report on the industrial chemicals market but the movement against contracts, in the aggregate, continues to cover good volumes, and there has been a fair amount of new inquiry. Export business remains reasonably good but competitive.

The price position generally is unchanged with a steady undertone, and for the most part supplies are adequate for immediate needs.

A little more activity has been reported in agricultural chemicals with a broadening interest in fertilisers.

Pitch is in good request on an otherwise quiet coal-tar products market.

MANCHESTER Traders on the Manchester chemical market report that the majority of industrial consumers are taking up supplies against current commitments satisfactorily although there is still room for improvement in this respect so far as textile and allied industries in particular are concerned.

There is a fairly steady movement on shipping account. The general price position shows little change on balance, the undertone being steady. In several sections of the fertiliser market, including basic slag and like compounds, activity has been maintained.

GLASGOW The past week did not present any significant change in conditions generally in the Scottish heavy chemical market. A more or less normal level of trading was maintained, with demands in some sections of industry showing a slight falling off.

Prices continued on a steady basis showing little change. In regard to agricultural chemicals, the position still remains quiet, with, however, some interest now being shown in forward requirements for next season. The export market still continues satisfactory.

Kestner Jubilee Dinner

Just over 100 guests celebrated the golden jubilee dinner of the Kestner Evaporator and Engineering Co. Ltd. at a dinner in the Savoy Hotel, London WC2, on Tuesday, 21 October, when each guest was presented with a copy of the Kestner Jubilee Book, 1908-1958. Among the guests were Mr. H. W. Cremer, Professor D. M. Newitt and M. Myon (of the French Kestner company).

Mr. J. A. Reavell, founder and chairman of the company presided.

Imperial College Exceeds Target for Students

Six new professors and 12 new readers have been appointed to the Imperial College of Science and Technology during the year; eight of these are new posts established by the University of London. They represent new academic developments in a number of fields including applied electron physics, heat transfer, nuclear technology and physical oceanography. This was announced by Dr. R. P. Linstead, rector, at the annual commemoration day ceremony held in the Royal Albert Hall last week. Lord Bridges was the special visitor.

Dr. Linstead said that there are 2,580 students at the college this session, of whom 1,650 are undergraduates and 930 postgraduates. The college plan for expansion made some years ago, set a target of 2,550 students for 1959/60.

High-Impact P.V.C. Effluent Pipe

By installing high-impact p.v.c. piping in place of a metal pipe for effluent disposal at Barry, British Geon Ltd. have made a considerable saving. During the twelve months since its installation, a 400-ft. length of pipe has remained completely unaffected by the effluent which contains H_2SO_4, HCl, NaOH and chlorinated hydrocarbons. The pipe is manufactured by Extrudex Ltd., Bracknell, Berks.

TANTIRON

pipes, vessels & fittings for handling Corrosives

SILICON IRON

Tantiron, the registered trade name applied to Silicon Iron Castings, was first cast and produced on a commercial scale by The Lennox Foundry Co. before 1910, so we are well justified in our claim that it is the first—and still the best—high silicon resisting iron.

Tantiron is manufactured into Pumps, Valves, Dephlegmators, Pipes, Cocks, Absorption Towers, Pans, Reaction Vessels, Coolers, etc.

Tantiron resists most of the known persistent corrosive agents.

Tantiron Pipes, Valves and Fittings are subject to a hydraulic test before despatch and test certificates furnished when requested.

Lennox

LENNOX FOUNDRY CO. LTD.

Tantiron Foundry, Glenville Grove, London, S.E.8

NEW PATENTS

By permission of the Controller, HM Stationery Office, the following extracts are reproduced from the 'Official Journal (Patents)', which is available from the Patent Office (Sale Branch), 25 Southampton Buildings, Chancery Lane, London WC2, price 3s 3d including postage; annual subscription £8 2s.

Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

AMENDED SPECIFICATIONS

On Sale 3 December or as soon as possible thereafter

Catalytic reforming of gasoline hydrocarbons. Universal Oil Products Co. **732 189**

Sulphuric acid. Metallgesellschaft, AG. **732 881**

ACCEPTANCES

Open to public inspection 3 December

Chromium and cobalt complex compounds of monoazo dyestuffs of the benzene-azo-naphthalene series. Sandoz, Ltd. **805 217**

Polyhydroxy-substituted polyethers, their preparation and resinous products prepared therefrom. Bataafsche Petroleum Maatschappij N.V., de. **805 258**

Iron-nickel-chromium alloys. British Driver-Harris Co. Ltd. **805 187**

Multiply sheet materials containing polyethylene. Union Carbide Corp. **805 389**

Bis (4-beta-hydromethyl-1-naphthyl) disulphide. Goodyear Tire & Rubber Co. **805 218**

Separators for removing water from hydrocarbon liquids. Fram Corp. **805 415**

Obtaining a concentrate of titanium dioxide and a concentrate containing metallic iron from raw materials containing titanium and iron. Tikkanen, M. H. A. **805 438**

Esters of halides of dibasic organic acids. Merck & Co., Inc. [Divided out of 805 295] **805 297**

Derivatives of octanoic acid. Merck & Co., Inc. [Divided out of 805 295.] **805 298, 805 299, 805 300**

α, α-Dichloroisovaleric acid and its salts. Dow Chemical Co. **805 260**

Preparation of acrylic esters. Dow Chemical Co. **805 259**

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Working refractory metals. Imperial Chemical Industries Ltd., and Bradley, H. **805 541**

Surface treatment of metallic uranium. Gray, A. G., and Schweikher, E. W. **805 781**

Uranium alloys useful for the release of atomic energy. Imperial Chemical Industries Ltd. **805 782**

Removal of oxides of sulphur from flue gases. Newall, H. E. **805 531**

Separation of crystalline mixtures. Power-Gas Corp. Ltd. **805 731**

Manufacture of ammonium sulphate. Simon-Carves, Ltd. **805 471**

Process for the manufacture of finely divided silica. Imperial Chemical Industries, Ltd. **805 491**

Finishing leather with resin dispersions. Imperial Chemical Industries, Ltd., Cole, G. H. T., and Guest, D. J. **805 492**

Oxygenated steroids and process of making same. Reichstein, T. **805 693**

Aldosterone intermediates. Reichstein, T. **805 604**

Manufacture of pregnenals and derivatives thereof. Ciba Ltd. **805 601**

Manufacture of products of enzymatic oxidation. Ciba Ltd. **805 602**

Catalytic condensation of diglycol esters of dicarboxylic acids. Gevaert Photo-Producten N.V. **805 534**

Electrodeposition of antimony. Harshaw Chemical Co. **805 755**

Process for dechlorinating potable and industrial waters containing active residual chlorine. Veb Farbenfabrik Wolfen. **805 659**

Alumina-silica pigments and their preparation. Columbia-Southern Chemical Corp. **805 494**

Lubricants. Monsanto Chemical Co. **805 553**

Steroid intermediates for the preparation of adrenocortical hormones. Glaxo Laboratories, Ltd. **805 497**

Dehydrochlorination process. Distillers Co., Ltd. **805 816**

Gas-washing apparatus. Didier-Werke, AG. **805 635**

Ammonia saturators. Simon-Carves, Ltd. **805 558**

Means for feeding liquids into concentrating vessels. Fletcher & Co., Ltd., and Murray, C. W. **805 636**

Container for the storage of water-repellent liquids. Gerdes, H. **805 788**

Manufacture of fire-resistant fabrics. Greengate & Irwell Rubber Co., Ltd. **805 499**

Process for purifying trichloro- and tetrachlorobutanes. Distillers Co., Ltd. **805 817**

Herbicidal compositions and substances for use therein. Monsanto Chemical Co. **805 500**

Steroid compounds and methods for preparing them. Merck & Co., Inc. **805 582**

Cyclobutane derivatives. Du Pont de Nemours & Co., E. I. **805 664**

Control of froth flotation plant. Simon-Carves, Ltd. **805 701**

Diphenylether derivatives and process for the preparation thereof. National Research Development Corp. **805 761**

Insecticidal compounds and compositions and processes for the manufacture thereof. Murphy Chemical Co., Ltd., and Pianka, M. **805 737**

Electrodeposition of zinc. Sylvania Electric Products, Inc. **805 762**

Sonic gas analysers. Grubb Parsons & Co., Ltd., Sir H. **805 544**

Production of niobium and tantalum compounds. UK Atomic Energy Authority. **805 501**

Irradiating flat stock organic polymers. General Electric Co. **805 818 & 805 819**

Plasticised linear aromatic polyester compositions. Goodyear Tire & Rubber Co. **805 586, 805 587, 805 589, 805 590**

Method of plasticising linear aromatic polyesters. Goodyear Tire & Rubber Co. **805 588**

Composite materials comprising glass and metal compositions. Owens-Corning Fiberglas Corp. **805 703**

Carburetting water gas with heavy oil. Humphreys & Glasgow, Ltd. **805 682**

Sulphur-containing organic esters and their salts and process for the preparation thereof. Morren, H. **805 704**

Coal tar pitch compositions. Coal Tar Research Assoc. **805 655**

Monoazo dyestuffs of the benzene-azonaphthalene series and metal complexes thereof. Imperial Chemical Industries, Ltd. **805 560**

Preparation of halohydrocarbons or mixtures thereof. Imperial Chemical Industries, Ltd. **805 764**

Production of foamed materials, using polyurethane foam waste. Koepp & Co. Chemische Fabrik AG. **805 561**

Cooling of hot crude coal gases and the production of purified condensed products. North Western Gas Board. **805 706**

Phthalocyanine compounds. Imperial Chemical Industries, Ltd. **805 562**

Fluorination catalyst and process. Dow Chemical Co. **805 503**

Production of 1-dehydrosteroids. Abildgaard, K. [trading as Lovens Kemiske Fabrik Ved A. Kongsted]. **805 563**

Compositions comprising surface active agents. Scottish Oils, Ltd., and Stewart, D. **805 741**

Method of and apparatus for the treatment of incrusting liquids, to prevent scale deposition therefrom. Vermeiren, T. I. S. **805 484**

Preparation of macromolecular polymethylene terephthalates Onderzoekingsinstituut Research N.V. **805 504**

Esters of cyclopentanophenanthrene compounds and process for their production. Laboratoires Francais de Chimiotherapie. [Addition to 768 801.] **805 564**

Protecting walls of a reaction vessel from attack by corrosive materials. Horizons Titanium Corp. **805 767**

Detergent composition. Pharmax, Ltd. **805 768**

Accelerators of vulcanisation of rubber. Goodyear Tire & Rubber Co. **805 742**

Substituted benzoylacetanilides. Imperial Chemical Industries, Ltd. **805 505**

Manufacture of glass tubes. Mullard Radio Valve Co., Ltd. **805 670**

Therapeutic compositions. Pfizer & Co., Inc., C. **805 769**

Reinforced glass-containing articles based on polypyromellitimides. Du Pont De Nemours & Co., E. I. **805 770**

Synthetic resinous material surfaced with metal. Montecatini Soc. Generale per L'Industria Mineraria e Chimica. **805 566**

Esters of piperonylic acid and insecticidal compositions thereof. Stafford Allen & Sons, Ltd. [Addition to 716 519.] **805 743**

Production of acrylonitrile. Farbenfabriken Bayer AG. **805 744**

Method and apparatus for extracting comtaminants from a liquid-permeable body. Bendix Aviation Corp. **805 567**

Recovery of uranium by ion exchange. Permutit Co., Ltd. **805 745**

Accelerating the sedimentation of coarse and colloidal dispersed solids from coal-washing waters. Badische Anilin- & Soda-Fabrik AG. **805 673**

Dyestuffs of the α-nitroso- β-naphthol series. Badische Anilin- & Soda-Fabrik AG. **805 568**

Crucible for melting metal in an arc furnace. Titanium Metals Corp. **805 546**

Local anaesthetic composition and preparation thereof. Cook-Waite Laboratories, Inc. **805 523**

Urea salts of dicarboxylic acids. Imperial Chemical Industries, Ltd., Alsberg, F. R., and Jeffers, F. G. **805 507**

Production of regenerated protein threads, fibres, filaments and the like. Courtaulds, Ltd. **805 508**

Local anaesthetic compositions. Goldberg, S. D. **805 524**

Production of organo-silicon compounds. Imperial Chemical Industries, Ltd. [Cognate applications 10639 and 26011.] **805 674**

Manufacture of nitriles. Imperial Chemical Industries, Ltd. **805 651**

Improving the properties of polyethylene terephthalate threads and fibres and textile fabrics manufactured therefrom. Vereinigte Glanzstoff-Fabriken AG. **805 525**

1-Diaryl-2-amino alkanols. Mead Johnson & Co. **805 511**

Method for clarifying water. Dow Chemical Co. **805 526**

Production and use of antistatic compositions. Union Carbide Corp. **805 549**

Hydrophenanthrene compounds and process for their manufacture. Reichstein, T. [Divided out of 805 603.] **805 605**

Cyclodiene-halosilane treated mineral pigments and uses thereof. Esso Research & Engineering Co. **805 512**

Arrangement in evaporation and distillation plants of the type comprising a boiler, a cyclone separator, and a vapour condenser. Niro Atomizer A. S. **805 747**

Process for treating shaped polymeric articles to improve dyeability. Dow Chemical Co. **805 513**

Petroleum fuel oil compositions. Esso Research & Engineering Co. **805 550**

Production of an active alumina catalyst of high shape retention. Badische Anilin- & Soda-Fabrik AG. **805 652**

Production of alpha- and gamma-modifications of metal free phthalocyanine in solvent-table form. Badische Anilin- & Soda-Fabrik AG. **805 514**

Gasoline motor fuel additive and fuel containing same. Standard Oil Co. **805 773**

Heating of oxygen-contaminated halogen-containing vapours. Du Pont de Nemours & Co., E. I. **805 570**

Filtration. Whirlpool Corp. **805 489**

Production of 3-substituted 4-hydroxy-coumarins and the 1-thio analogues thereof. Geigy, AG. J. R. **805 748**

Apparatus for partitioning and separating dissolved substances by fractionation between two liquid phases. Deutsche Gold- und Silber-Scheideanstalt Vorm. Roessler. **805 727**

Production of titanium dioxide. Du Pont de Nemours & Co., E. I. **805 572**

Cracking hydrocarbons in the liquid state. Deutsche Gold- und Silber-Scheideanstalt Vorm. Roessler. [Addition to 794 367.] **805 618**

Purification of gases. Standard Telephones & Cables, Ltd. **805 516**

Polymerisable mixtures. Badische Anilin- & Soda-Fabrik AG. **805 574**

Coating compositions. Du Pont de Nemours & Co., E. I. **805 527**

Textile bleaching process. Du Pont de Nemours & Co., E. I. **805 749**

Separation of filter material from carbon black. Badische Anilin- & Soda-Fabrik AG. **805 658**

Moth-proofing compositions. Farbenfabriken Bayer AG. **805 774**

Preparation of phosphoric acid. Makhtsavei Israel. **805 517**